User Manual

Allen-Bradley

PowerMonitor 1000 Unit

Catalog Numbers 1408-BC3A-485, 1408-BC3A-ENT, 1408-TS3A-485, 1408-TS3A-ENT, 1408-EM3A-485, 1408-EM3A-ENT

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made in this revision.

Topic	Page
Added pre-installation instructions. These instructions include: • Equipment Required • Temporarily Connect Power • Connect the Ethernet Network • First Run Web Page • Initial Network Configuration	15
Added instructions on how to mount the PowerMonitor 1000 Unit section.	19
Added instructions on how to wire the PowerMonitor 1000 Unit.	21
Updated instructions for using a Web browser to set up the PowerMonitor 1000 unit.	36
Added instructions on how to use the LCD screen to set up the PowerMonitor 1000 unit.	38
Added instructions on how to use the Terminal Emulation Software for setup.	44
Added a section on security.	51
Added information about the Alarm Log.	71
Added information about restoring factory default settings.	74
Added a section for unit setup by using explicit messaging.	96
Added data tables for the following functions: • Security Policy Configuration • Security Policy Status • Security UserName • Security Password • Alarm Status Results • Alarm Log Results • Alarm Log Code • DF1 PCCC Diagnostic Status Reply • Parameter Object Instances	Appendix A
Added Additional EtherNet/IP Information appendix.	Appendix D

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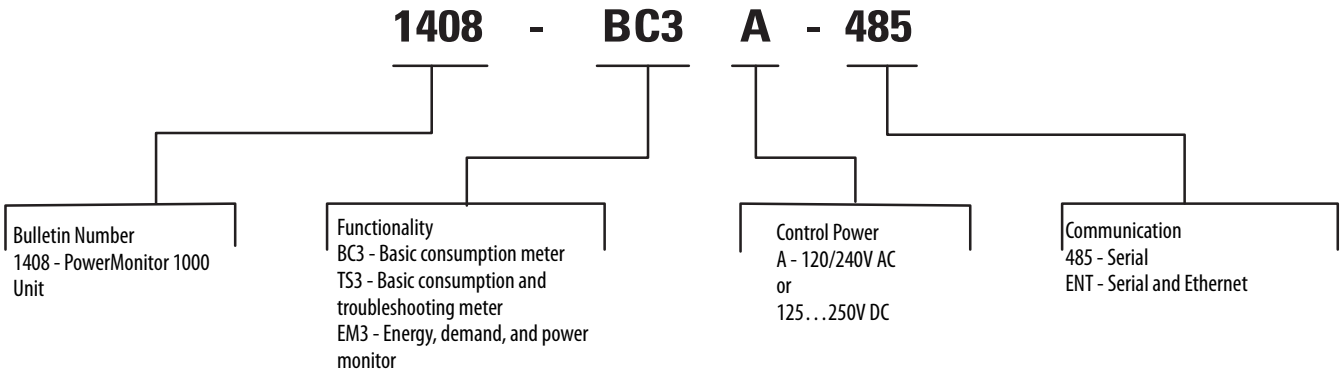
Before You Begin

Use this document as a guide to set up communication with the Bulletin 1408 PowerMonitor 1000 unit using other applications and controllers. This document is intended for advanced users. You must already be familiar with data communication and programmable controller messaging.

Catalog Number Explanation


1408 - BC3 A - 485
Bulletin Number
1408 - PowerMonitor 1000 Unit
Functionality
BC3 - Basic consumption meter
TS3 - Basic consumption and troubleshooting meter
EM3 - Energy, demand, and power monitor
Control Power
A - 120/240V AC or 125…250V DC
Communication
485 - Serial
ENT - Serial and Ethernet

Who Should Use This Manual

You must have a basic understanding of electrical circuitry and familiarity with relay logic, industrial communication, and programmable controllers. If you do not, obtain the proper training before using this product.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

PowerMonitor 1000 Overview

Safety

Follow these advisories when using this product.

ATTENTION: Only qualified personnel, following accepted safety procedures, can install, wire, and service the power monitor and its associated components. Before beginning any work, disconnect all sources of power and verify that they are de-energized and locked out. Failure to follow these instructions can result in personal injury or death, property damage or economic loss.

ATTENTION: Never open a current transformer (CT) secondary circuit with primary current applied. Include a shorting terminal block in the CT secondary circuit when wiring between the CT's and the power monitor. A shorting block, line fuses, and control power fuses are included in the power monitor accessory kit, catalog number 1400-PM-ACC. Shorting the secondary with primary current present allows other connections to be removed if needed. An open CT secondary with primary current applied produces a hazardous voltage, which can lead to personal injury, death, property damage or economic loss.

IMPORTANT The power monitor is neither designed for, nor intended for, use as a circuit protective device. Do not use this equipment in place of a motor overload relay or circuit protective relay.

About the PowerMonitor 1000 Unit

The power monitor is a compact, cost-effective, electric power, and energy metering device intended for use in industrial control applications, such as destribution centers, industrial control panels, and motor control centers. It measures voltage and current in an electrical circuit, meeting revenue accuracy standards. It communicates power and energy parameters to applications such as FactoryTalk® EnergyMetrix™, SCADA systems, and programmable controllers, over Ethernet or serial networks. The power monitor works with these applications to address key customer applications.

- Load profiling – log power parameters such as real power, apparent power, and demand, for analysis of power usage by loads over time
- Cost allocation – reporting actual energy cost by department or process to integrate energy information into management decisions

- Billing and sub-billing – charging users of energy the actual usage cost rather than allocating by square footage or other arbitrary methods
- Power system monitoring and control – display and control power flow and energy utilization
- Capacitor bank control - provides real and reactive power values for use in a PLC-based control system

PowerMonitor 1000 Unit Features and Functions

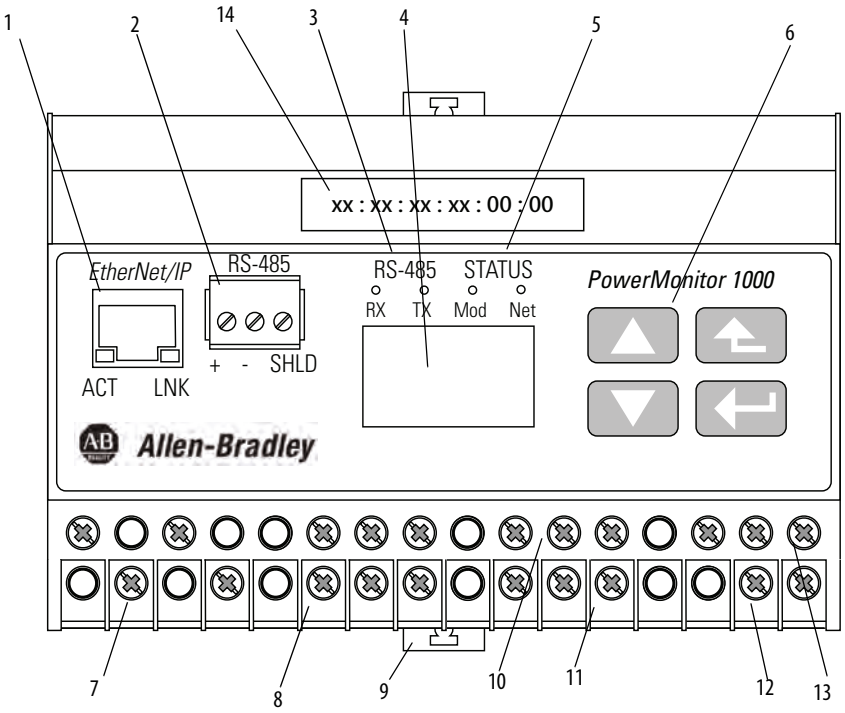
The power monitor connects to the user's three-phase or split-phase AC power system directly or through instrument transformers (PTs and CTs). The power monitor converts instantaneous voltage and current values to digital values, and uses the resulting digital values in calculations of voltage, current, power, and energy.

The power monitor family includes three models:

- BC3 - Basic consumption meter
- TS3 - Basic consumption and troubleshooting meter
- EM3 – Energy, demand, and power monitor

PowerMonitor 1000 unit models TR1, TR2, EM1, and EM2 have been discontinued.

Hardware Features



Feature	Description	BC3	TS3	EM3
1. Ethernet network port - standard RJ-45 jack with status indicators	Ethernet network port hardware is included on all models. The port functions only on units ordered with or upgraded to the Ethernet network. The following protocols and functions are supported. • EtherNet/IP • Modbus TCP • HTML Web page for configuration and data access LNK indicator – Solid GREEN: IP link established – Off: no link established ACT indicator – Flashing YELLOW: data present on Ethernet port – Off: no data activity present	X	X	X
2. Serial port - three-pin RS-485 connector	All models include RS-485 serial communication that support the following protocols and functions. • DF1 half-duplex slave • DF1 full-duplex • Modbus RTU slave • Configuration by using terminal emulation software • DH-485	X	X	X
3. Serial port status indicators	• TX indicator flashes YELLOW when data is being transmitted • RX indicator flashes YELLOW when data is being received	X	X	X
4. LCD	• Unit configuration • Data display – Not present on BC3 model		X	X
5. Module and network status indicators	• Module indicator – GREEN: Normal operation – Alternating RED/GREEN: Performing self-test – RED (solid or blinking): Initial power-up or failed self-test • Network indicator – GREEN: Ethernet connection established – Blinking GREEN: Ethernet port looking for a connection – RED: Duplicate IP address detected	X	X	X
6. LCD interface buttons	• Unit configuration • Data display navigation – Not present on BC3 model		X	X
7. Voltage-sensing wiring terminals	• Direct connect up to 600V AC three-phase line-to-line • Maximum nominal line-to-ground voltage 347V • Use potential transformers (PTs) for higher voltages	X	X	X
8. Current-sensing wiring terminals	• Nominal input current 5 A • Use current transformers (CTs) to connect to power system	X	X	X
9. DIN-rail clips	• Top and bottom clips for mounting unit on DIN rail	X	X	X
10. Status-input wiring terminals Restore factory defaults wiring terminals (BC3)	• Two internally-powered inputs (TS3, EM3) • S2 can be used for demand period synchronization (TS3, EM3) • FD1 and FD2 can be used to restore factory default configuration (BC3).	X	X	X
11. Configuration-lock wiring terminals	• Wire together to prevent configuration changes	X	X	X
12. KYZ-output wiring terminals	• DPDT solid-state relay for signaling use – Not present on BC3 model		X	X
13. Control power and ground wiring terminals	• 120…240V AC, 50…60 Hz	X	X	X
14. MAC ID label	• aa:bb:cc:dd:ee:ff, used when assigning an IP address using DHCP; X; X; X	X	X	X

Functionality by Model

The power monitor models differ by the data sets available to client applications. This table indicates the measurements and functions available in each model.

Table 1 - Model Functions

Measured Parameters	1408-BC3A	1408-TS3A	1408-EM3A
kW	X	X	X
kVAR	X	X	X
kVA	X	X	X
True Power Factor	X	X	X
kWh	X	X	X
kVARh	X	X	X
kVAh	X	X	X
Voltage		X	X
Current		X	X
Frequency		X	X
Voltage Unbalance		X	X
Current Unbalance		X	X
kW Demand			X
kVAR Demand			X
kVA Demand			X
Projected kW Demand			X
Projected kVAR Demand			X
Projected kVA Demand			X
Demand Power Factor			X
Time Of Use Log	X	X	X
Energy Log	X	X	X
Minimum/Maximum Log	X	X	X
Load Factor Log			X
Status Log	X	X	X
Display		X	X
Alarms			X
Status Input		X	X
KYZ Output		X	X

Troubleshooting mode lets you enter a password-protected command that temporarily promotes your PowerMonitor unit to an EM3 model. This makes all measured parameters available for troubleshooting purposes.

Communication Overview

All PowerMonitor 1000 units come standard with an RS-485 serial communication port. Models with catalog numbers ending in -ENT are equipped with an Ethernet 10BaseT communication port. This section covers serial and Ethernet communication, the available protocols, and what protocols to use for your application.

What Can I Do Using Communication Networks?

When you use communication networks with the power monitor you can do the following things.

- Configure analog input parameters such as PT/CT ratios
- Configure communication parameters such as IP address
- Read real-time power and energy data
- Read energy logs

Serial Communication

The RS-485 serial communication port allows serial communication to your power monitor. This port can be configured to communicate using the protocols listed the this table.

Protocol	Applications
DF1 Half-duplex Slave	The DF1 Half-duplex Slave protocol can be used for point-to-point or multi-drop communication when using a DF1 Polling Master driver in RSLinx Classic software, or using explicit messages from Rockwell Automation controllers communicating via DF1 Half-duplex Master.
DF1 Full-duplex	The DF1 Full-duplex protocol can be used only for point-to-point communication using a RS-232 DF1 driver for RSLinx® software, or when using explicit messages from Rockwell Automation controllers communicating via DF1 Full-duplex.
Modbus RTU Slave	The Modbus RTU Slave protocol can be used for point-to-point or multi-drop communication with a client using the Modbus RTU Master protocol for PLC controller communication.
Auto-sense	With auto-sense selected, the RS-485 port switches among the available serial protocols based on the format of the packets the port receives.
DH485	The DH485 protocol can be used for point-to-point or multi-drop communication using a 1747-PIC/AIC+ driver for RSLinx software, or when using explicit messages from Allen-Bradley controllers or HMI (PanelView) terminals communicating via DH485.
ASCII	The ASCII protocol is used with terminal emulation software to configure and read data using point-to-point communication.

TIP All devices communicating on a serial network must be configured with the same data rate and data format.

DH485 Protocol

DH485 is a token-passing protocol that allows messaging by up to 32 nodes on a serial network. The master is the node that owns the token; only the master can transmit messages. When a node has completed transmitting messages, it passes the token to the next node.

The power monitor does not initiate DH485 data messages. When requested, it transmits reply messages to the initiator when it gets the token, and then passes the token to its successor.

TIP PowerMonitor 1000 units only support DH485 Local Link messages and do not support Send and Receive Data (SRD) messages for DH485 non-token passing slave devices.

The DH485 protocol uses the same data table addressing as DF1 protocols. Please refer to the CSP file number column of PowerMonitor 1000 data tables.

The following configuration factors have a significant effect on network performance and must be considered when you plan a DH485 network.

- Number of Nodes - unnecessary nodes slows the data transfer rate. The maximum number of nodes on the network is 32. Fewer nodes are better.
- Node Addresses - best to start node addresses at 0 and assign in sequential order. Controllers cannot be node 0. Assigned the lowest numbered addresses to initiators such as personal computers.
- Communication Rate - higher is better. All devices must be at the same communication rate.
- Maximum Node Address - set as low as possible to reduce the time it takes to initialize the network.

Ethernet Network Communication

The Ethernet network communication port allows communication with your power monitor using a local-area-network (LAN). The Ethernet port can also be used to view the internal webpage of the power monitor. This Ethernet port uses a static IP address by default (DHCP address assignment optional), and can simultaneously communicate by using the protocols listed below. The Ethernet communication port supports 10 Mbps data rate, half-duplex.

EtherNet/IP Protocol

The power monitor supports the EtherNet/IP protocol for communicating via Ethernet or EtherNet/IP drivers in RSLinx Classic software, or when using explicit messages from Rockwell Automation controllers communicating via Ethernet or EtherNet/IP network.

Modbus TCP Protocol

Modbus TCP protocol is also supported for communicating via Modbus TCP for communication.

TIP When configuring Ethernet communication, verify that IP addresses do not conflict with the existing infrastructure, and that subnet masks and gateways are properly set.

Installation and Setup

Pre-installation Setup

We recommend that you perform at least a minimal setup of the Ethernet PowerMonitor 1000 unit prior to installation. This setup establishes a security policy holder and sets up the network port addressing so that the unit setup can be completed over the Ethernet network after the unit is installed, wired, and power is applied.

IMPORTANT Pre-installation setup of the BC3 model is especially important since the BC3 model has no display or keypad, and therefore all configuration must be done by using communication.

This section describes the equipment and steps needed to perform pre-installation setup.

IMPORTANT If the catalog number of your power monitor ends in -485, refer to the Use Terminal Emulation Software for Setup section.

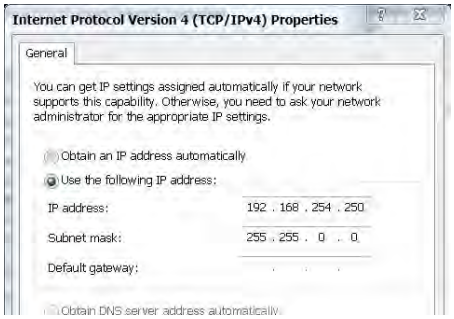
Equipment Required

The following equipment is needed for initial setup of the unit:

- A personal computer that can run Internet Explorer web browser
- A standard or cross-over patch Ethernet communication cable
- A power cord

Set up your computer LAN port with a fixed address. These are the recommended settings:

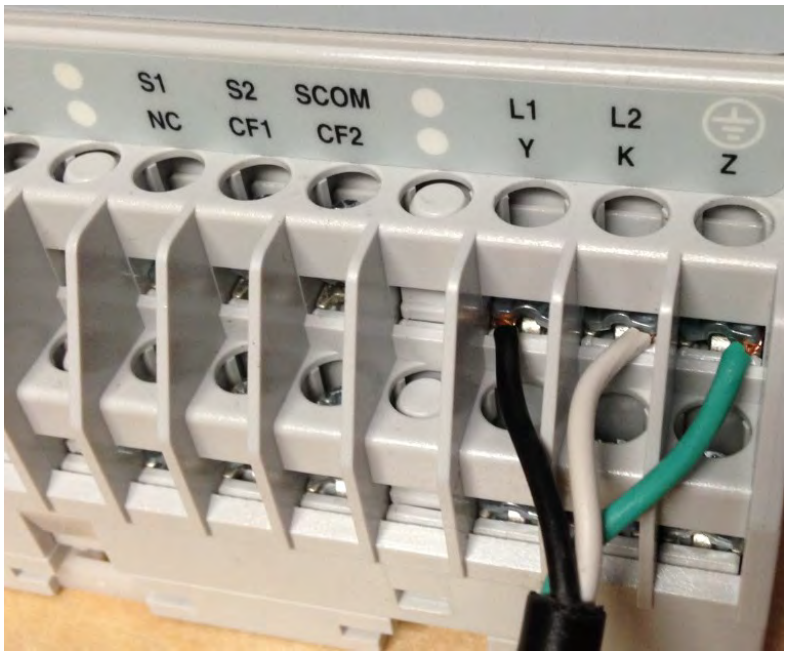
- IP address: 192.168.254.250
- Subnet mask: 255.255.0.0
- Gateway: none required


Internet Protocol Version 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 254 . 250
Subnet mask:
255 . 255 . 0 . 0
Default gateway:
Obtain DNS server address automatically

Temporarily Connect Power

Connect an un-plugged power cord to the PowerMonitor 1000 unit as shown in Figure 1. L1 to L2 voltage must be 120...240V AC, 50...60 Hz. The ground terminal must be connected to earth ground. After the power cord is connected, plug it in to a suitable electrical outlet. After the power-on self-test (POST) is complete, the left status indicator remains lit.

Figure 1 - Temporary Power Connection



Connect the Ethernet Network

Connect the unit Ethernet port to your computer LAN port. The following methods can be used:

- Connect by using a cross-over UTP patch cable
- Connect by using two straight through UTP patch cables and a hub or switch
- Connect by using a straight through UTP patch cable, if your computer NIC supports Auto MDI-X

First Run Web Page

Follow these steps after you have connected your computer to the PowerMonitor 1000 unit via the Ethernet network.

1. Open Internet Explorer web browser and browse to the default IP address 192.168.254.x, where x is the Unit ID found on the label on the left end of the unit.

2. When the first run web page appears, enter a policy holder user name, a password, and password confirmation.

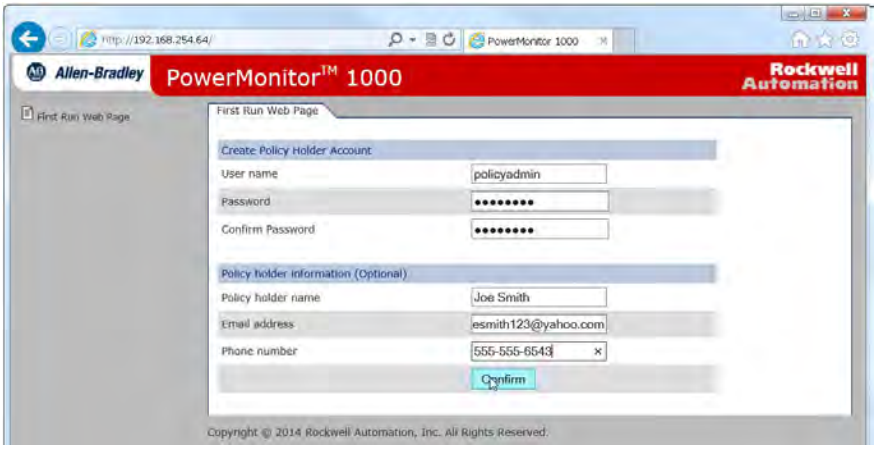
   You can also optionally enter your contact information.

3. Click Confirm.

IMPORTANT A security policy holder username and password must be entered in order to configure and use the PowerMonitor 1000 unit.

IMPORTANT Write down the policy holder username and password and keep them in a secure location. If these credentials are lost or forgotten, the factory default configuration has to be restored to recover the ability to configure security in the unit.

Figure 2 - Set Security Policy



4. Confirm the prompt to reload the web pages.

   You can choose to continue with the security policy setup at this time or wait until later. See the Security section for further information.

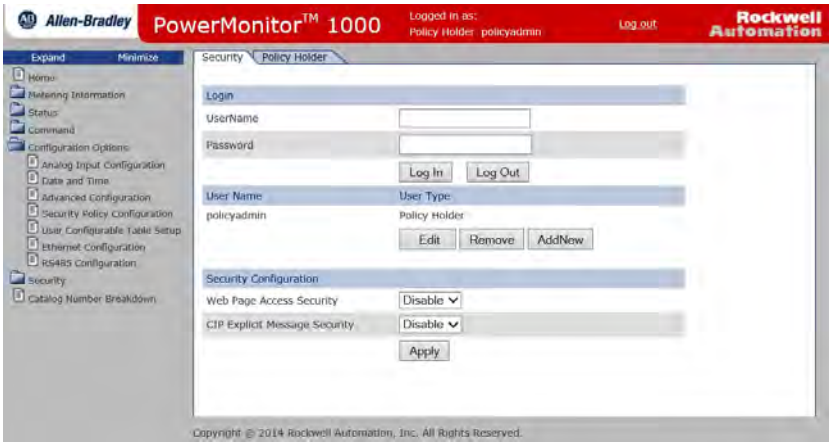
- If you choose to set up security now, you are already logged in as the policy holder. You can add admin and/or application users and enable web page access and CIP explicit message security.
- If you choose to wait, do not enter anything into the page, click Log Out and confirm when prompted. To set up security at a later time, log in with the policy holder username and password and select the Security web link.

With security disabled, the unit configuration is protected from inadvertent or unauthorized changes by a Table Password, with a default value of 0. You can assign a different table password by using the Advanced Configuration web link.

TIP If you have updated firmware in a Series A PowerMonitor 1000 unit, the table password remains the same as it had been prior to the update.

With security enabled, an admin user must be logged in to the web page to modify the unit configuration. The table password fields are disabled and are ignored by the unit.

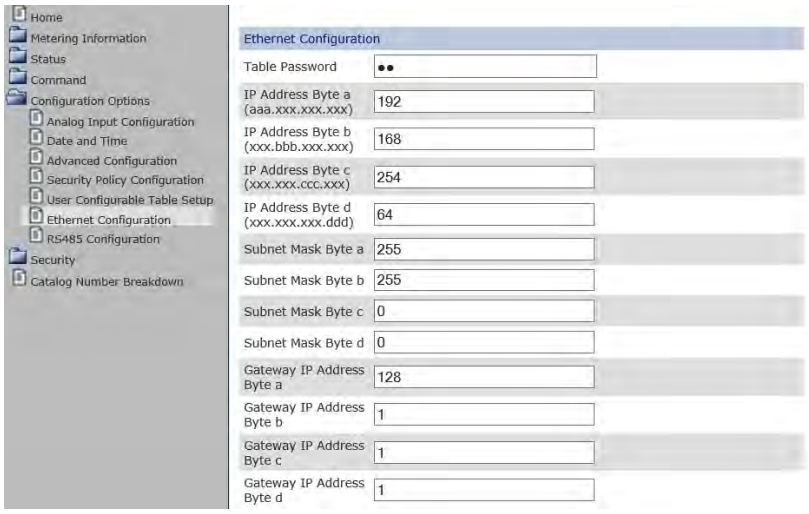
Figure 3 - Security Enabled



Initial Network Configuration

The next step is to assign the Ethernet network address. Follow these steps to assign a fixed address.

1. Expand the Configuration Options folder and select Ethernet Configuration.
2. Enter the table password, the four bytes of the IP address, subnet mask, and gateway address.



3. When the values are entered, click Apply to store and apply the new network address.

   Your power monitor unit is now ready to be installed. The unit is capable of communicating on the Ethernet network and ready to accept your final configuration.

Mount the PowerMonitor 1000 Unit

Mount the PowerMonitor 1000 unit in a suitable protective enclosure. Select an enclosure that protects the unit from atmospheric contaminants, such as oil, water, moisture, dust, corrosive vapors, and other harmful airborne substances.

The enclosure must protect against personal contact with energized circuits. The ambient temperature within the enclosure must remain within the limits listed in Appendix B, Specifications. Select an enclosure that provides adequate clearance for ventilation and wiring for the power monitor and other equipment to be installed within the enclosure.

See PowerMonitor 1000 Unit Dimensions on page nn for dimensions and spacing guidelines for the power monitor.

When installed within a substation or switchgear lineup, we recommend that the power monitor be mounted within a low-voltage cubicle, isolated from medium and high-voltage circuits. Be sure that the mounting panel is properly connected to a low-impedance earth ground.

Mount the enclosure in a position that allows full access to the unit. The power monitor can be mounted on a panel or a DIN rail.

Panel Mount

Follow these steps to mount the unit on a panel or any flat surface.

1. Extend the top and bottom DIN rail clips to the panel mount position.
2. Insert a small screwdriver under the spring pin to move the clip, lift it, and pull the clip forward until it extends approximately 6 mm (0.25 in.) from the enclosure.
3. Release the pin and lock the clip in the panel mount position.
4. Mount the unit by using three M4 or #8 machine screws.

DIN Rail Mount

You can mount the unit on standard 35 x 7.5 mm (EN 50 022 – 35 x 7.7) DIN rail. To mount on a DIN rail, leave the mounting clips retracted so the mounting holes are hidden behind the unit.

Install

Follow these steps to mount the unit on a DIN rail.

1. Tilt the bottom of the unit slightly away from the rail until the notches grab onto the top flange of the DIN rail.
2. Push the bottom of the enclosure forward towards the DIN rail.

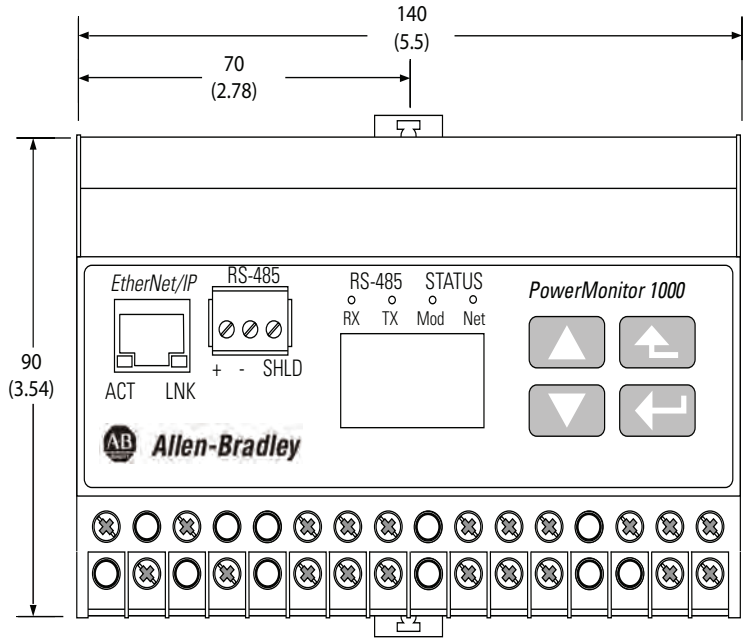
   The spring-loaded clip snaps onto the bottom of the rail and holds the unit firmly in place.

Remove

Follow these steps to remove the unit from a DIN rail.

1. Insert a small screwdriver into the exposed slot in the tab to remove the unit from the DIN rail.
2. Pull enclosure forward and remove from the rail.

Product Dimensions



All dimensions are mm (in.).
Panel mount depth 59 mm (2.4 in.).
DIN-rail mount depth 62 mm (2.44 in.).
Hole spacing tolerance: ±0.4 mm (0.016 in.).

We recommend that you mount PowerMonitor 1000 units in a horizontal orientation against a vertical mounting panel or DIN rail. Units can be mounted immediately adjacent to each other horizontally. It is recommended to leave a space of 1 inch (25 mm) vertically between the power monitor and the enclosure or adjacent equipment.

Wire the PowerMonitor 1000 Unit

The power monitor has finger-safe screw terminals with pressure plates for all wiring connections.

Figure 4 - Terminal Block Layout (BC3 model)

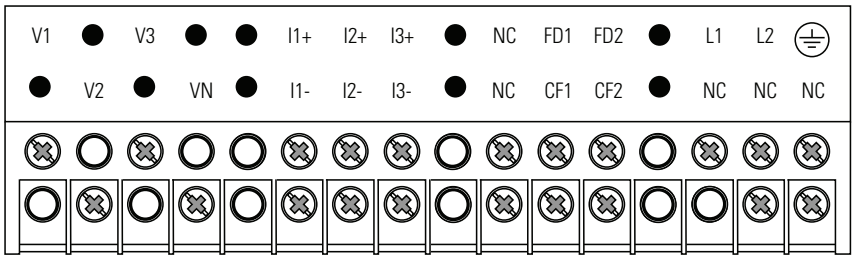
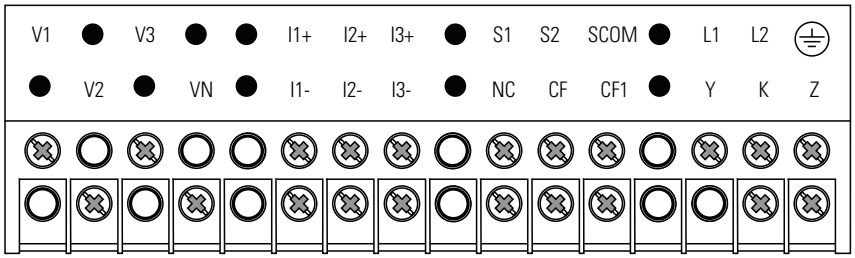


Figure 5 - Terminal Block Layout (TS3, EM3 models)



Wire Type	Wire Size Range	Wires per Terminal	Recommended Torque
Cu - 75 °C (167 °F)	0.33…0.21 mm^2 (22 … 14 AWG)	2 max per terminal, sol-sol or str-str only (no mixed pairs)	0.8 N•m (7 lb•in)

Voltage Sensing

The PowerMonitor 1000 unit monitors a variety of three-phase and single-phase circuits. Voltages of up to 600V AC line-to-line (347V AC line-to-ground) can be connected directly. Higher voltages require potential transformers (PTs), also known as voltage transformers (VTs).

Wiring must conform to all applicable codes and standards. In particular, you must provide suitable overcurrent protection with current and interrupting ratings selected to protect the wiring. Line fuses, a control power fuse, and a CT shorting block are included in the power monitor accessory kit, catalog number 1400-PM-ACC. The accessory kit is available from your local Allen-Bradley distributor or Rockwell Automation sales representative.

Pay particular attention to correct phasing and polarity of voltage connections. The diagrams use the dot convention to indicate transformer polarity. The dot indicates the H1 and X1 terminals on the high side and low side of the transformer respectively.

When you wire a power monitor to existing PTs and metering devices, the voltage-sensing terminals of the power monitor must be connected in parallel with the voltage-sensing terminals of the existing metering devices.

IMPORTANT Ungrounded three-wire Delta systems with line-to-line voltages between 347…600V AC can be directly connected. However, if a ground fault occurs that raises the line-to-ground voltage above 347V AC, the unit indicates a voltage over-range condition.

The following wiring diagrams indicate typical voltage sensing connections to various types of power systems.

Figure 6 - 3-phase, 4-wire Wye, Direct Connect (600V AC Line-to-line, 347V AC Line-to-neutral Maximum)

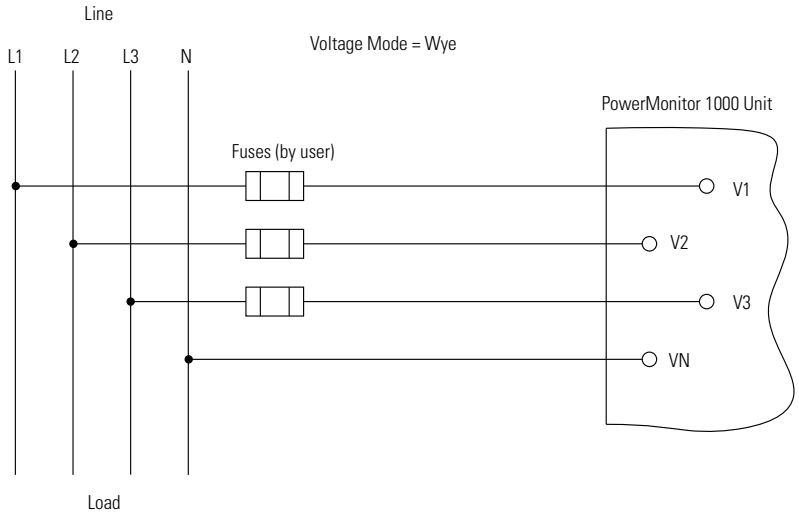


Figure 7 - 3-phase, 3-wire Grounded Wye, Direct Connect (600V AC Line-to-line, 347V AC Line-to-neutral Maximum)

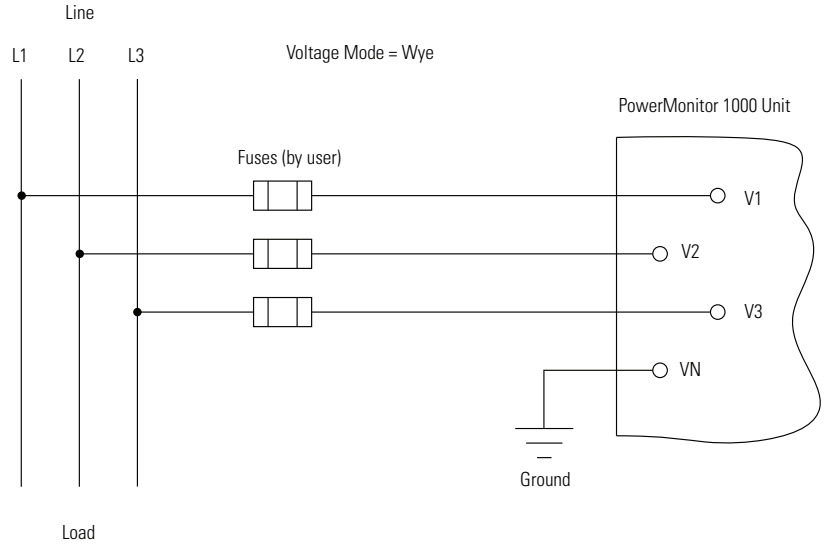


Figure 8 - 3-phase, 4-wire Wye with Potential Transformers

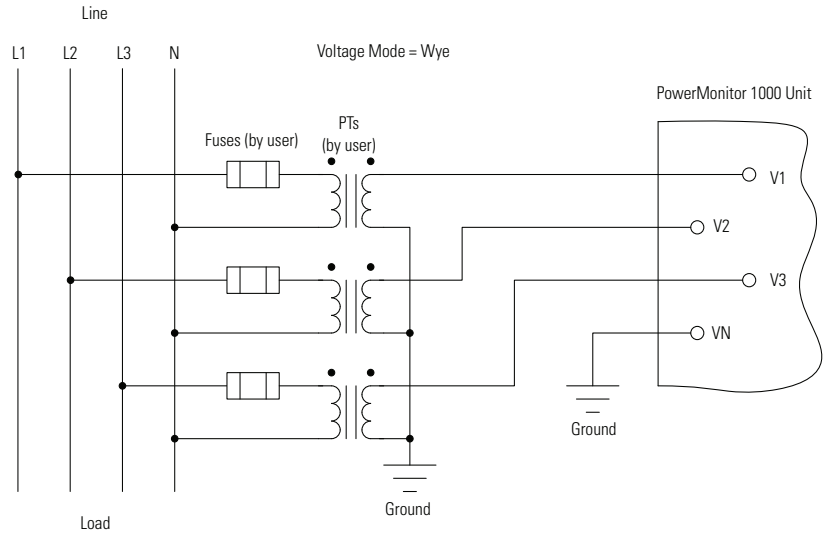


Figure 9 - 3-phase, 3-wire Grounded Wye with Potential Transformers

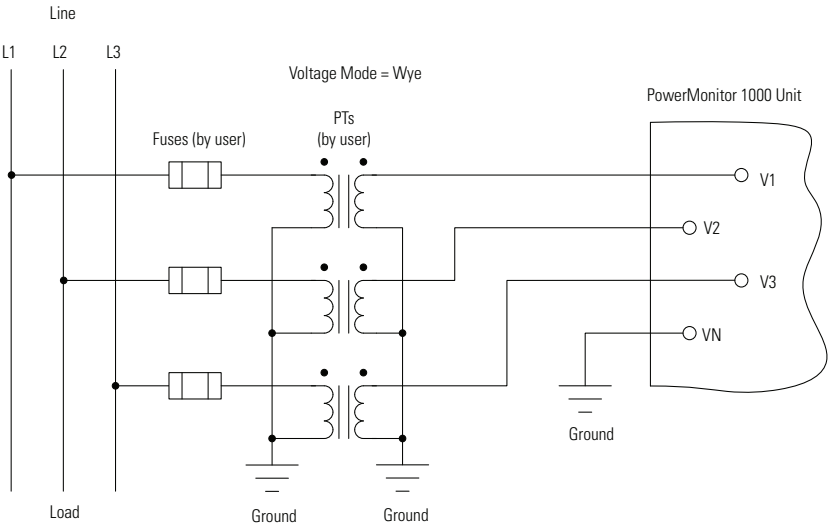


Figure 10 - 3-phase, 3-wire Open Delta with Two Potential Transformers

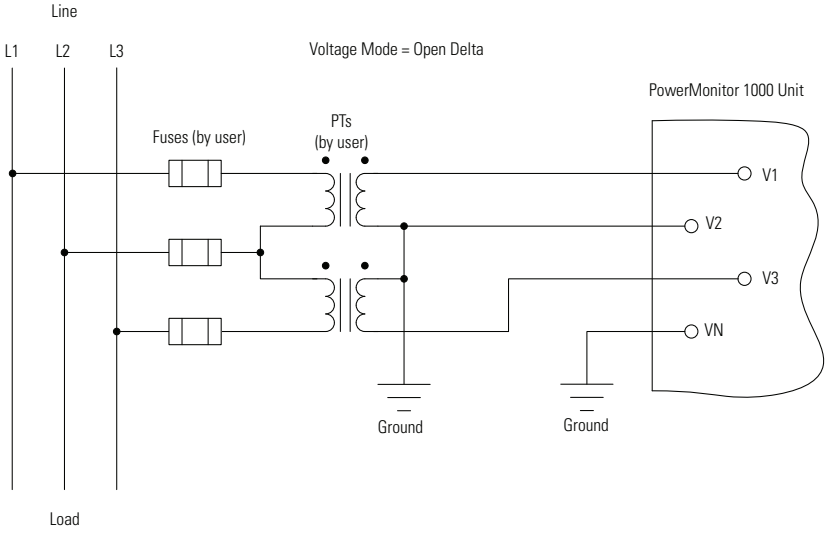


Figure 11 - Split-phase, Direct Connect (600V AC Line-to-line, 347V AC Line-to-neutral Maximum)

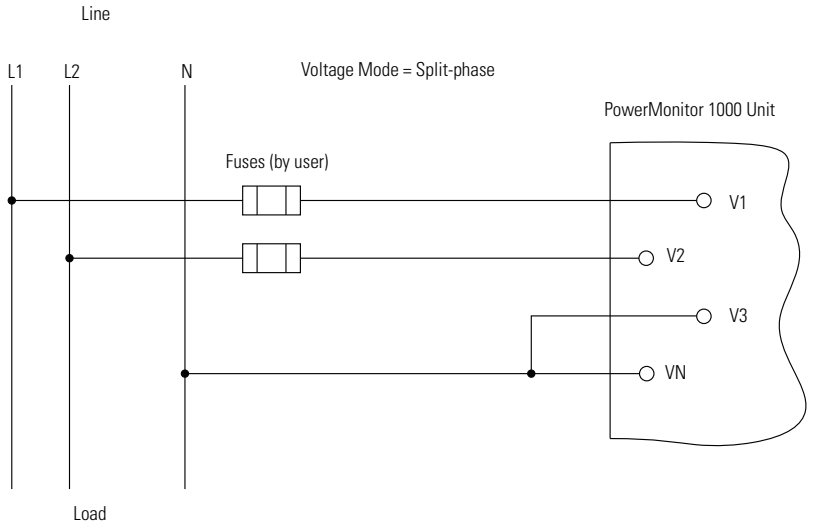


Figure 12 - Split-phase with Potential Transformers

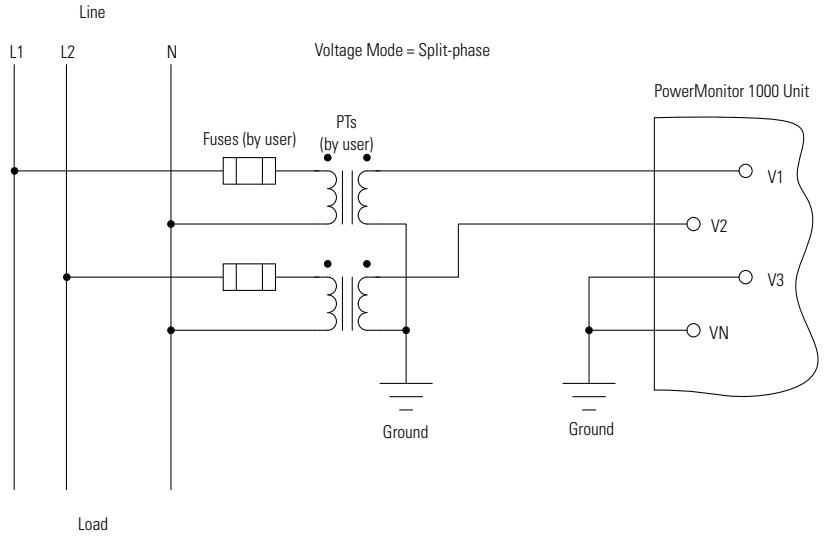
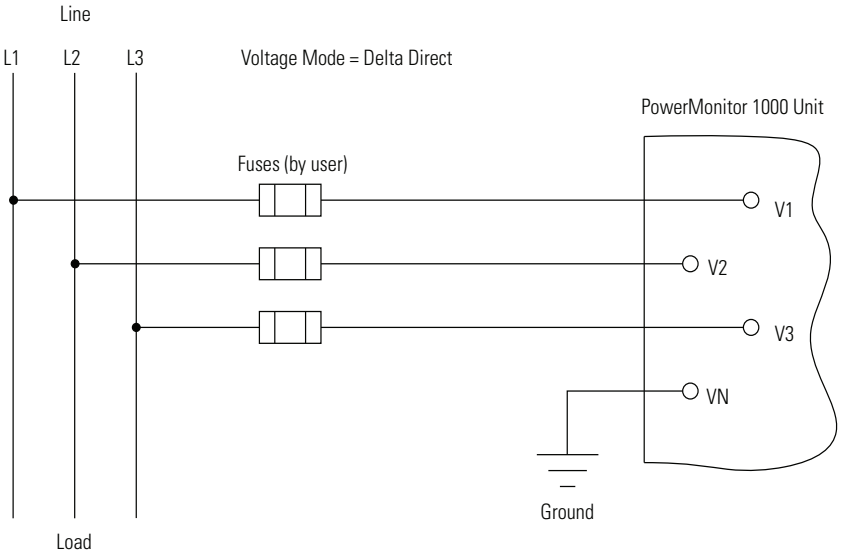
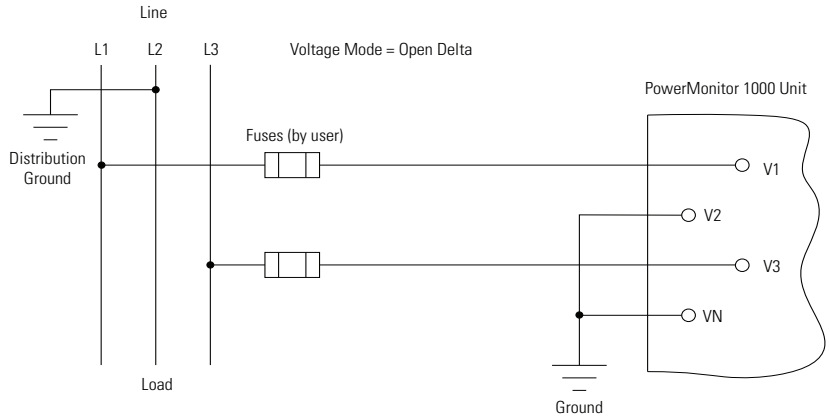


Figure 13 - 3-phase, 3-wire Delta, Direct Connect (600V AC Line-to-line, 347V AC Line-to-ground Maximum)



Maximum line-to-ground voltage is 347V. If line-to-ground voltage exceeds 347V, then potential transformers must be used. The unit indicates voltage overrange (999.0) if an intentional or accidental ground causes line-to-ground voltage in excess of 347V.

Figure 14 - 3-phase, 3-wire Grounded B-phase, Open Delta, Direct Connect (347V AC Line-to-line Maximum)



Maximum line-to-line voltage 347V. If line-to-line voltage exceeds 347V, then PTs must be used.

Current Sensing

The PowerMonitor 1000 unit provides wiring terminals for connection of current-sensing signals with a nominal range of 0.05...5 A. Current transformers (CTs) that you provide reduce the current in the circuit being monitored to the 5 A nominal input level.

CT specifications include their turns ratio, which specifies how much the current is reduced by the transformer. A typical CT ratio is 1200:5, where 1200 is the primary current in the circuit being monitored and 5 is the secondary current that is connected to the power monitor. In this case, a current of 600 A in the primary circuit results in a secondary current of 2.5 A. Some CTs have a 1 A nominal secondary circuit; these CTs can be used with the PowerMonitor 1000 unit, however, measurement resolution is reduced because only 20% of the metering range is used.

A variety of CTs are available, including split-core, solid core, round, square, and rectangular. See the Current Transformer Selection Matrix, publication 1411-SG001, for more information on CTs available from your local Allen-Bradley distributor or Rockwell Automation sales representative.

Use a shorting terminal block, test block, or shorting switch you provide for current transformer (CT) wiring to permit safely servicing connected equipment such as the power monitor without de-energizing the power system.

Use 0.21 mm^2 (14 AWG) wiring to connect the power monitor to the shorting block. Use 0.21 mm^2 (14 AWG) or larger wire between the shorting block and the CTs depending on the length of the circuit. Longer circuits require larger wire so that the burden of the wiring does not overload the CT and reduce system accuracy.

When you wire a power monitor to existing CTs and metering devices, the current-sensing terminals of the power monitor must be connected in series with the CT secondary and current-sensing terminals of the existing metering devices.

Do not install overcurrent protection or non-shorting disconnecting means in CT secondary wiring. Connect the current-sensing circuit to a low-impedance earth ground at only one point.

Pay particular attention to the correct phasing and polarity of current-sensing connections. The diagrams use the dot convention to indicate transformer polarity. The dot indicates the H1 and X1 terminals on the primary and secondary of the CT respectively. CTs with pigtail leads typically indicate the X1 (dotted) terminal with white wire and X2 with black wire. This convention runs counter to common wiring practicess in industrial settings, and can result in incorrect polarity of CT wiring. Phasing of the CTs must correspond to the phasing of the voltage-sensing connections.

The following wiring diagrams indicate typical current sensing connections to various types of power systems.

Figure 15 - 3-phase, 3- or 4-wire, 3-current Transformers

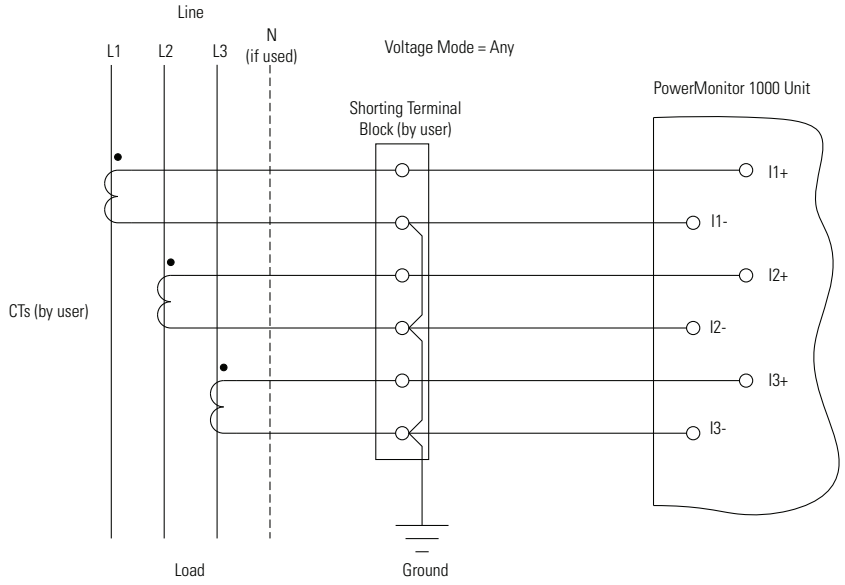
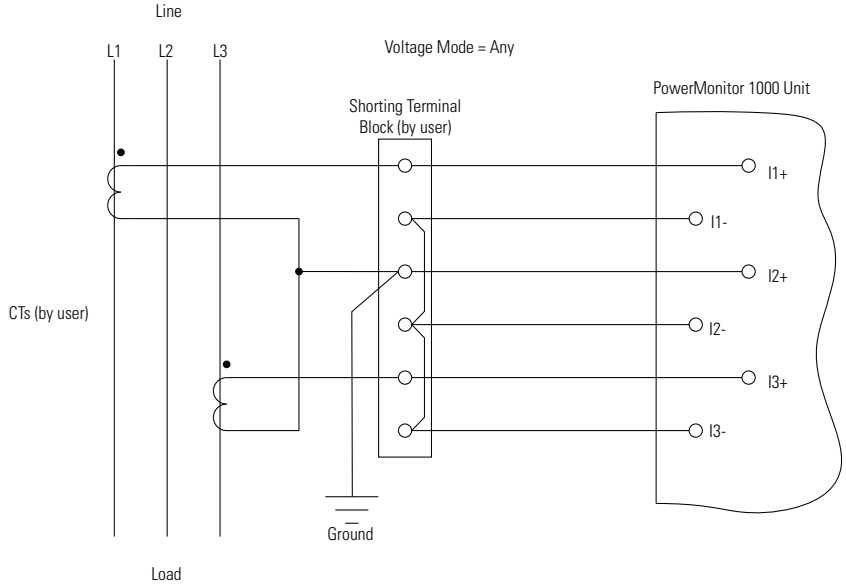
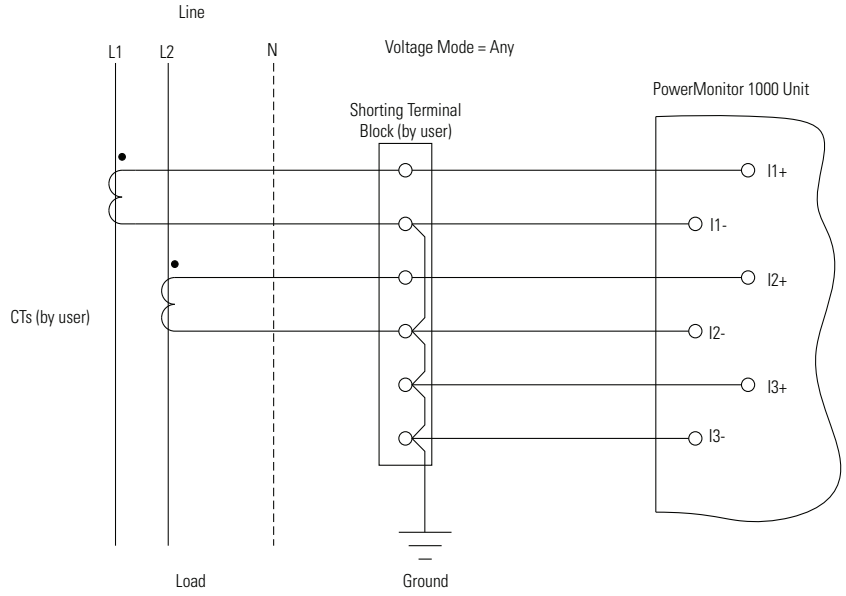


Figure 16 - 3-phase, 3-wire, 2-current Transformers



You can use two CTs only on three-wire systems.

Figure 17 - Split-phase, 2-current Transformers



Special Wiring Modes

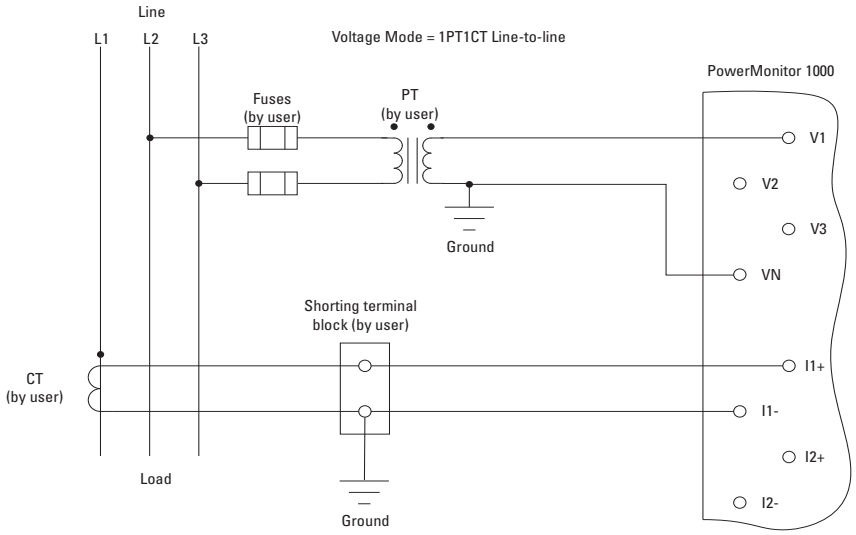
There are two special wiring modes for the power monitor.

1PT 1CT Line-to-line

This special wiring mode is designed for use in capacitor bank controllers. Traditional capacitor bank control measures V_{bc} and I_a to calculate reactive power and power factor. In this mode, the power monitor returns values as if it were configured in Delta mode. Three-phase values are estimated assuming a balanced load.

The following wiring diagram indicates the connections for the 1PT 1CT Line-to-line mode. A PT must be used. Wiring diagnostics are disabled in this mode.

Figure 18 - 1PT 1CT Line-to-line

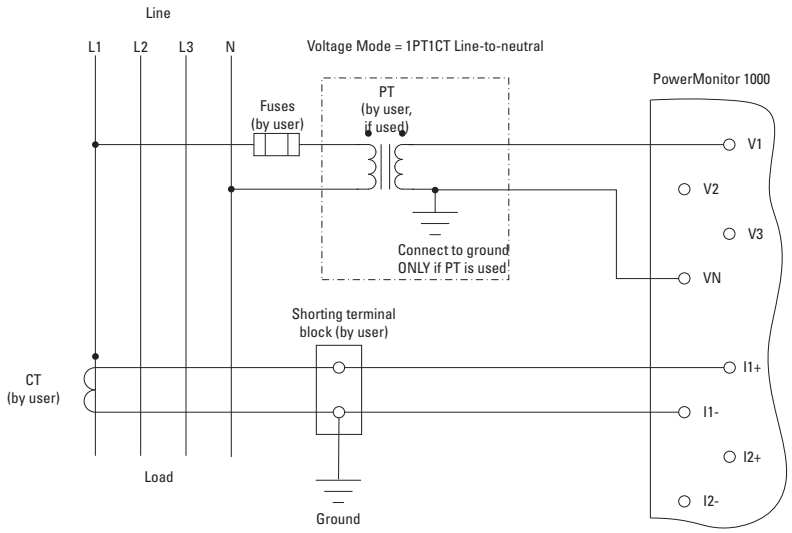


1PT 1CT Line-to-neutral

This special wiring mode is designed for use in new capacitor bank controller installations where the legacy metering connections described in the preceding section do not apply. In this mode, the power monitor returns values as if it were configured in Wye mode. Three-phase values are estimated assuming a balanced load.

The following wiring diagram indicates the connections for the 1PT 1CT Line-to-neutral mode. A PT is optional. Wiring diagnostics are disabled in this mode.

Figure 19 - 1PT and 1CT Line-to-Neutral

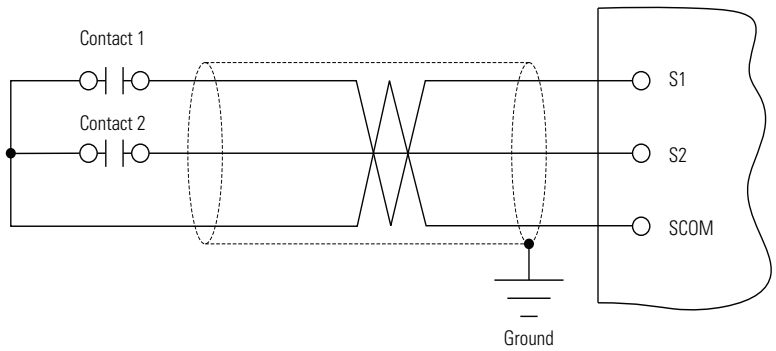


Status Inputs (except BC3 model)

One or two dry (non-powered) contacts can be connected to the power monitor status inputs. The power monitor 24V DC status input derives power from its internal power supply.

Connect status inputs by using shielded, twisted-pair cable with the shield connected to the ground bus or other low-impedance earth ground at one end only. The diagram indicates typical status input wiring.

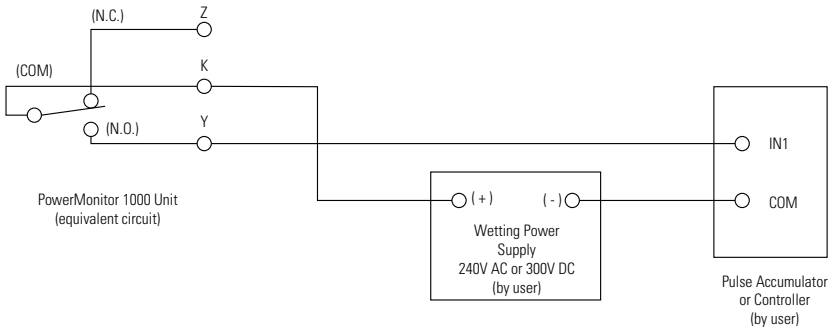
Figure 20 - Status Inputs (S1, S2)



KYZ Output (except BC3 model)

The KYZ solid-state relay output can be connected to an external pulse accumulator or controller. Wetting voltage must be provided by the external device or circuit. The KYZ output is designed for low-current (80 mA maximum) switching at up to 240V AC or 300V DC. The diagram indicates typical KYZ wiring.

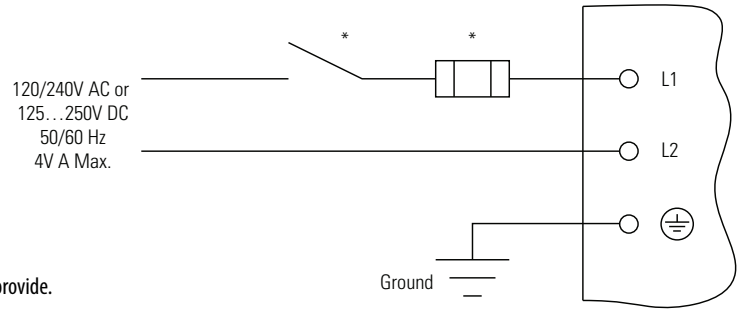
Figure 21 - KYZ Output



Control Power

Connect the power monitor to a source of 120/240V AC or 125...250V DC control power through a user-provided disconnecting means. Provide overcurrent protection sized to protect the wiring. The power monitor is internally protected. Apply control power only after all wiring connections are made to the unit.

Figure 22 - Control Power



Connect Communication

The following sections provide information on connecting Serial Communication and Ethernet Communication to the power monitor.

Serial Communication

Use point-to-point wiring between one power monitor and a computer or other data terminal for HyperTerminal communication and DF1 full-duplex communication. DF1 half-duplex, Modbus RTU, and DH-485 protocols permit a point-to-point or multi-drop network configuration.

Install multi-drop RS-485 communication wiring in a daisy-chain configuration. Up to 32 nodes can be connected together in a network. We recommend the use of Belden 9841 two-conductor shielded cable or equivalent. The maximum cable length is 1219 m (4000 ft). Use of a star or bridging topology is not recommended and can result in signal distortion unless impedance is matched for each spur (star topology) or network (bridge topology).

You must provide an RS-232 to RS-485 converter for communication between the power monitor serial port and an RS-232 port in an external device such as a computer or programmable controller. Examples of converters include the following:

- Allen-Bradley® catalog number 1761-NET-AIC
- B&B Electronics, Inc. part number 485SD9TB (DB-9 connection)
- B&B Electronics, Inc. part number USOPTL4 (USB connection)

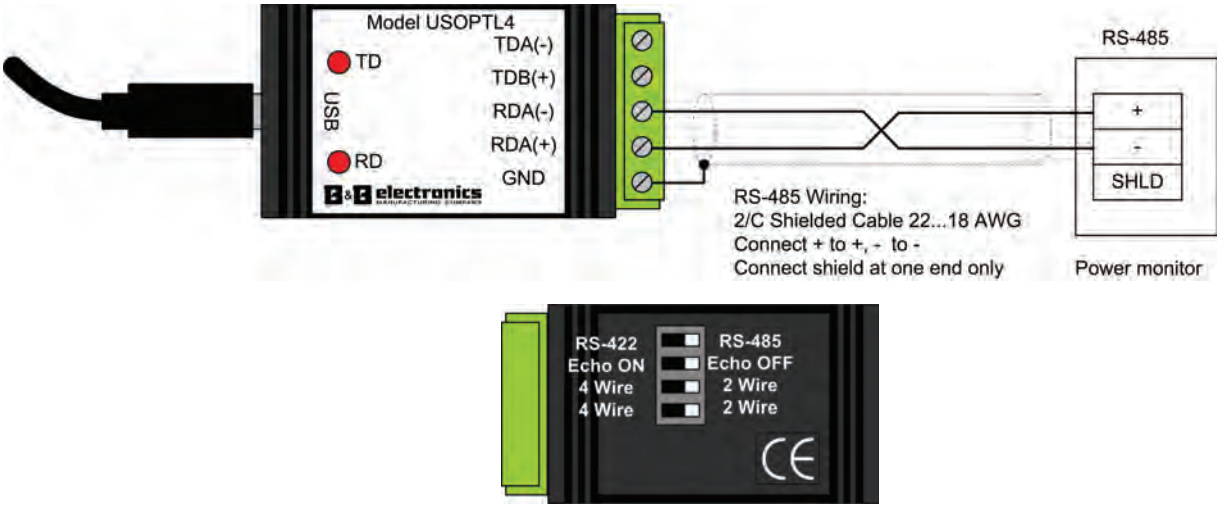
At one end of each cable segment, connect the cable shields to the SHLD terminal of the power monitor serial port or converter. The SHLD connection provides a low-impedance ground for high-frequency noise while attenuating DC or line-frequency signals.

If needed, install 150 Ω, ¼ W terminating resistors at the ends of the daisy-chain cable. Some RS-485 converters are equipped with internal terminating resistors. Contact the manufacturer of the converter for additional information.

TIP Wiring to the power monitor RS-485 port is the same as wiring to the PowerMonitor 3000 RS-485 port, but not the same as the PowerMonitor 500 RS-485 port.

See Use Communication to Set Up on page 49 for information on configuring serial communication parameters such as data rate and node addresses.

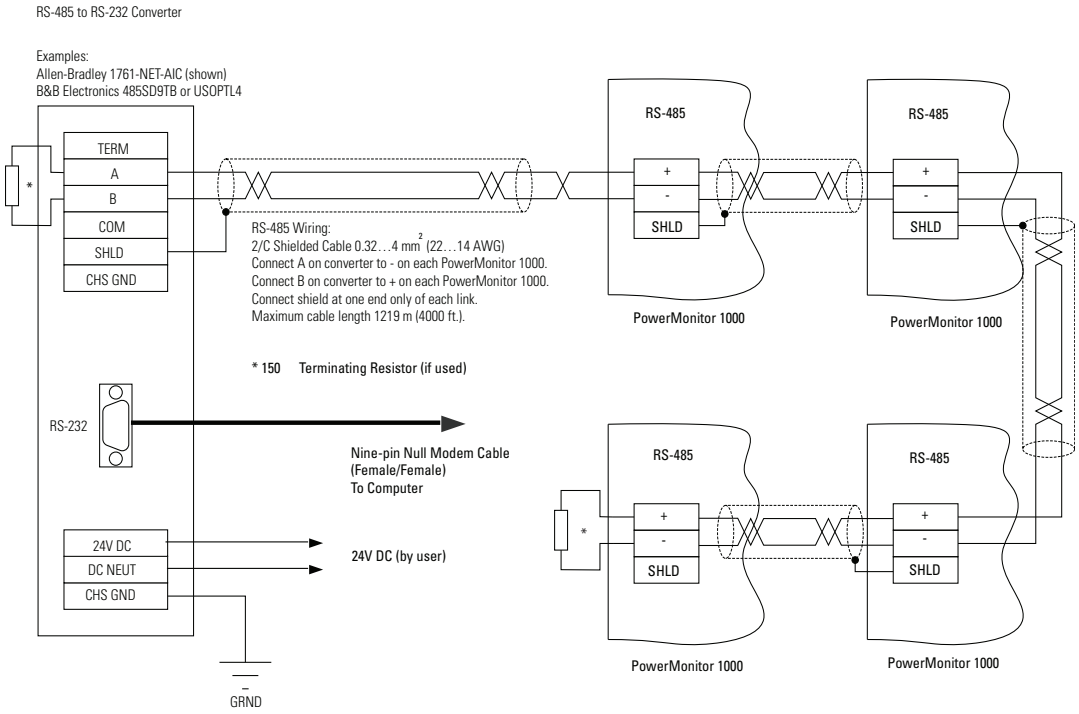
Figure 23 - RS-485 Point-to-point Typical Wiring



Terminals	Wire Range(1)	Tightening Torque
V1, V2, V3, VN, I1+ I2+, I3+, I1-, I2-, I3-, S1, S2, SCOM, NC, CR, CF1, L1, L2, Y, K, Z	0.32…4 mm^2 (22…14 AWG)	0.8 N•m (7 lb•in)
RS-485 Communication	0.32…4 mm^2 (22…14 AWG)	0.56 N•m (5 lb•in)

(1) 75 °C Cu wire only, 1 to 2 conductors per terminal (sol-sol or str-str).

Figure 24 - RS-485 Multi-drop Typical Wiring



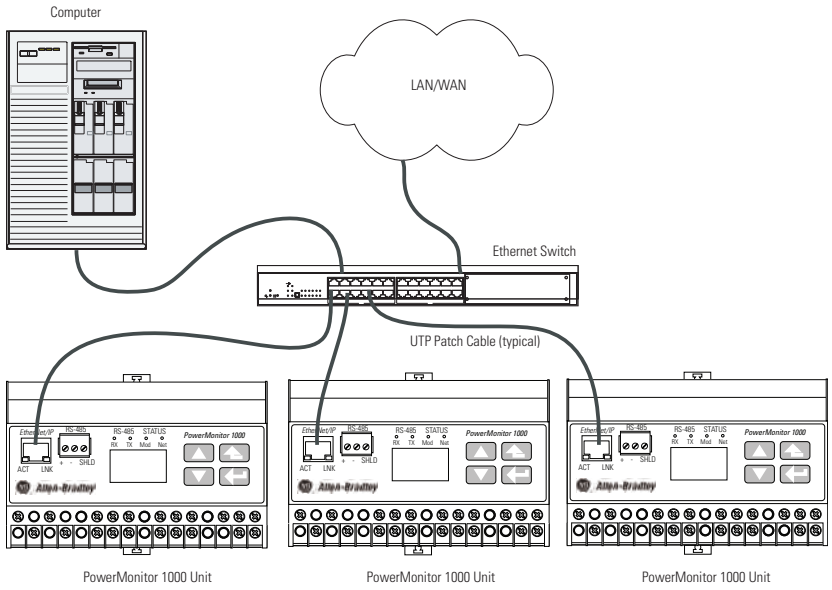
Ethernet Communication

The power monitor with optional Ethernet network communication connects easily to industry-standard Ethernet hubs and switches by using standard UTP (unshielded twisted-pair) cables with RJ-45 connectors.

Terminal	Signal	Function
1	TX+	Transmit + (TX+)
2	TX-	Transmit - (TX-)
3	RX+	Receive + (RX+)
4		
5		
6	RX-	Receive - (RX-)
7		
8		

Typical Ethernet connections are shown in this diagram.

Figure 25 - Ethernet Network Typical Connections



Ground the PowerMonitor 1000 Unit

In solid-state systems, grounding helps limit the effects of noise due to electromagnetic interference (EMI). Run the ground connection from the ground terminal of the power monitor to the ground bus or other low-impedance earth ground prior to connecting the control power or any other connections. Use 0.21 mm^2 (14 AWG) wire.

Grounding is also required in the voltage and current sensing circuits to limit the maximum voltage to ground for safety. Make all grounds to a common ground bus or terminal.

Set Up the PowerMonitor 1000 Unit

Although the power monitor ships from the factory with default settings, you need to configure it for your particular requirements. You can configure the power monitor by using the LCD interface (except for the BC3 model), a serial terminal emulation application, a Web interface, or other software. This section describes, in general, methods for setting up the power monitor.

Table 2 summarizes the setup options in the PowerMonitor 1000 unit.

Table 2 - Set Up Options

Category	Configuration Item	Classification	BC3	TS3	For More Information
Analog Input Configuration	Voltage Mode	Required			Analog Input Setup on page 55
	PT Ratio				
	CT Ratio				
	System Power Factor	Optional(1)			
Date and Time		Required(2)			Date and Time Functions on page 65
Advanced Configuration	New Table Password	Optional			Miscellaneous Functions on page 77
	Metering Averaging				Voltage, Current, and Frequency Metering on page 64
	Log Status Inputs		N/A		Miscellaneous Functions on page 77
	Daylight Saving Time				Date and Time Functions on page 65
	KYZ Output Setup		N/A		I/O Functions on page 72
	Demand Setup		N/A	N/A	Demand Metering on page 61
	Action on Error				Miscellaneous Functions on page 77
User Configurable Table	Parameter selections for Assembly Instance 1	Optional	N/A		Implicit Messaging on page 99
Ethernet Configuration	IP, Subnet Mask, Gateway	Required(3)			Optional EtherNet/IP on page 81
	SNTP	Optional			Date and Time Functions on page 65
	Demand Broadcast		N/A	N/A	Demand Metering on page 61
RS-485 Configuration	Protocol, Communication Rate, Delay, Data Format	Required(4)			Use Terminal Emulation Software for Setup on page 44

(1) Can change for effective Wiring Diagnostics.

(2) Data logging uses Date and Time.

(3) Required for units with Ethernet.

(4) Required for units with only RS-485, optional on Ethernet units.

Use Optional Software

FactoryTalk EnergyMetrix software (with the RT option) provides configuration interfaces for the power monitor, including the ability to upload, edit, download, and back up the unit configuration on a server. Refer to the FactoryTalk EnergyMetrix Software user manual, publication FTEM-UM002, or help files for information on configuring the power monitor using software.

Contact your local Allen-Bradley distributor, Rockwell Automation sales representative, or visit http://www.rockwellautomation.com/rockwellsoftware/ for more information on available software packages.

Use a Web Browser for Setup

You can use a web browser to view data and change configuration settings on your meter. Follow these steps to use the Web interface.

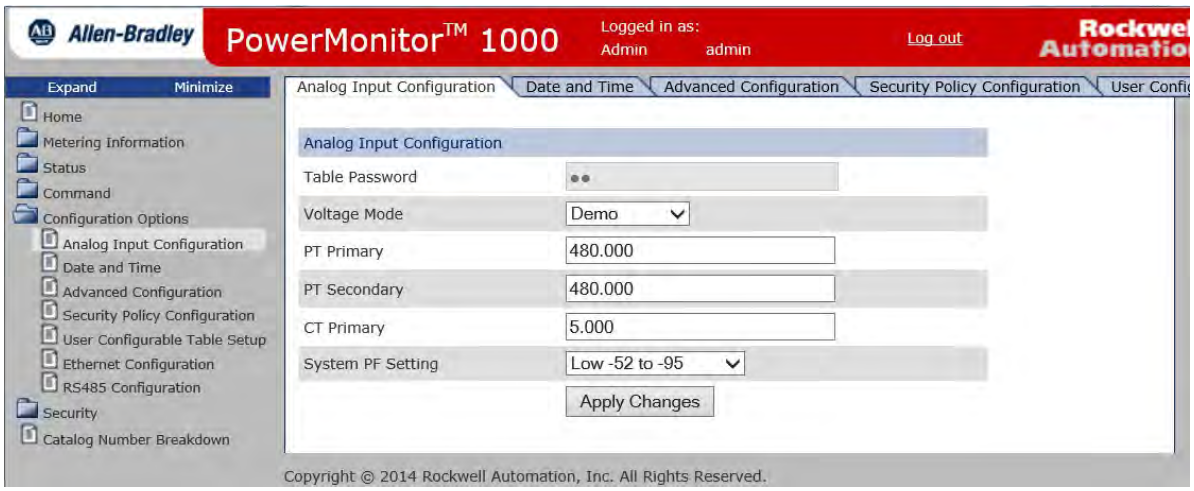
1. Use a computer that has network access to the power monitor, open your web browser, type the unit IP address in the address field, and press Enter.

   The power monitor's home page displays in your browser.

   The home page displays general information about the power monitor. The navigation menu is on the left.

2. In the left navigations pane, click Configuration Options to open the list of setup pages.

3. Click Analog Input Configuration to open the analog input setup page.



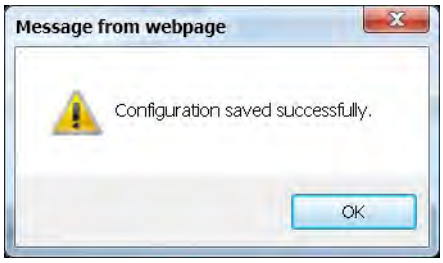
IMPORTANT Setup pages operate differently depending on whether security is enabled or disabled.

- If security is disabled, the Table Password and all available parameters are active. Enter the correct Table Password in addition to the desired values of the setup parameters.
- If security is enabled, you must log in with an Administrator account before setting up the unit. Until you log in, all parameters in the setup pages are inactive (grayed out). After you have logged in, the Table Password is inactive, as are any setup parameters that do not apply to the model of your PowerMonitor 1000 unit.

4. Select the Voltage Mode from the list, and enter values for PT primary, PT secondary, and CT primary.
   a. If applicable, select a different System PF Setting.
   b. If security is disabled, enter the correct Table Password.
   c. Click Apply when done.

   TIP Refer to Analog Input Setup on page 55 for additional information on parameter values and other setup selections.

   A message appears to indicate the status of the setup change. The happy path indication is:



   Other messages can appear, such as the following:
   - Password Rejected! - with security disabled, the Table Password entered is incorrect
   - Configuration Item Out of Range! - indicating that a parameter value exceeds its permitted range

5. Continue to set up the unit by selecting the remaining setup pages (for example, Date and Time and Advanced Configuration), entering setup parameters, and making selections from lists.
6. Click Apply to save your settings.

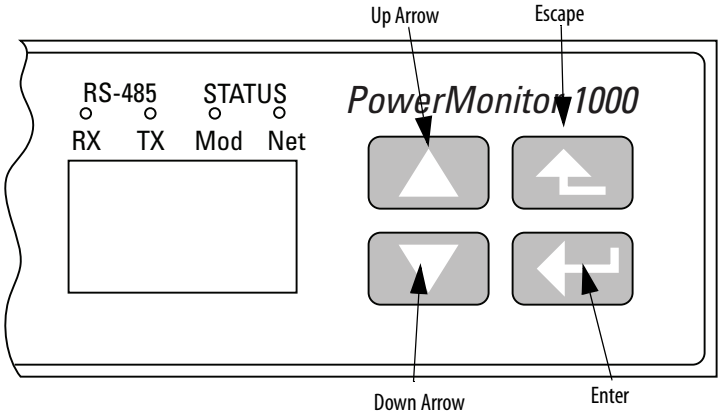
Use the LCD Screen (TS3 and EM3 models)

All models, except the BC3 model, include an onboard LCD for viewing and configuration. Buttons are provided to control the display. The display has three modes of operation:

- Display mode lets you select and view parameters including metering, event log, and self-test information.
- Program mode lets you change configuration parameters, with security against unauthorized configuration changes. Each power monitor is password protected.
- Edit mode lets you modify the selected parameters. In Edit mode, a highlight cursor appears under the value of the parameter being modified, starting at the right-hand (least significant) digit.

The diagram and table shows the LCD interface buttons and their functions.

Figure 26 - LCD Interface



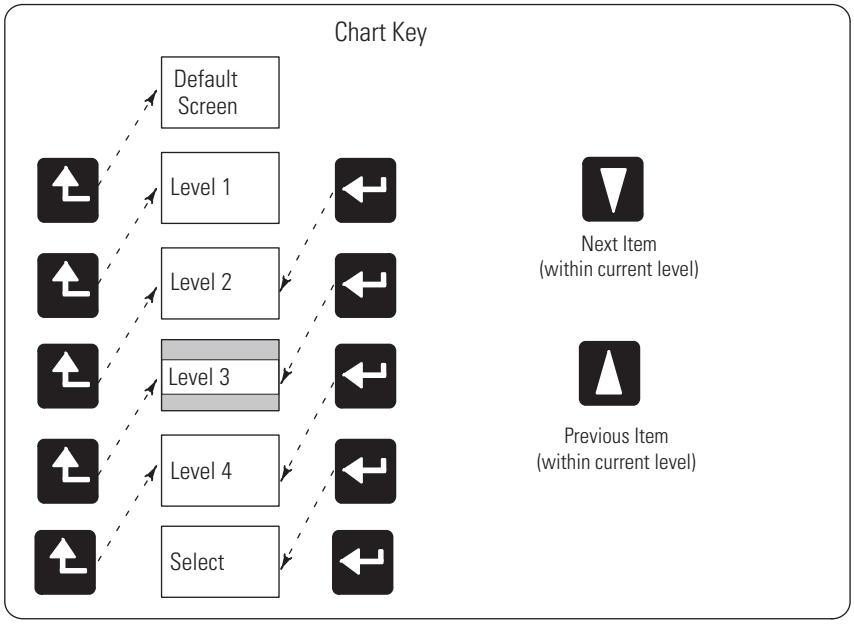
The buttons function differently in each mode. The power monitor enters into Display mode by default.

Button	Mode		
	Display	Program	Edit
Escape	Returns to parent menu At top menu, selects default screen		Cancels changes to the parameter and returns to Program mode
Up arrow	Steps back to the previous parameter or menu item		Increments the value of the highlighted digit
Down arrow	Steps forward to the next parameter or menu item		Decrements the value of the highlighted digit
Enter	Steps into a sub-menu or sets default screen	Steps into a sub-menu, selects the parameter to be modified or changes to Edit mode	Saves the parameter change and returns to Program mode
Up and down arrows together	Refreshes the display	No effect	Moves the highlight cursor one character to the left

User choices for display and configuration are organized in a hierarchical menu system within the power monitor.

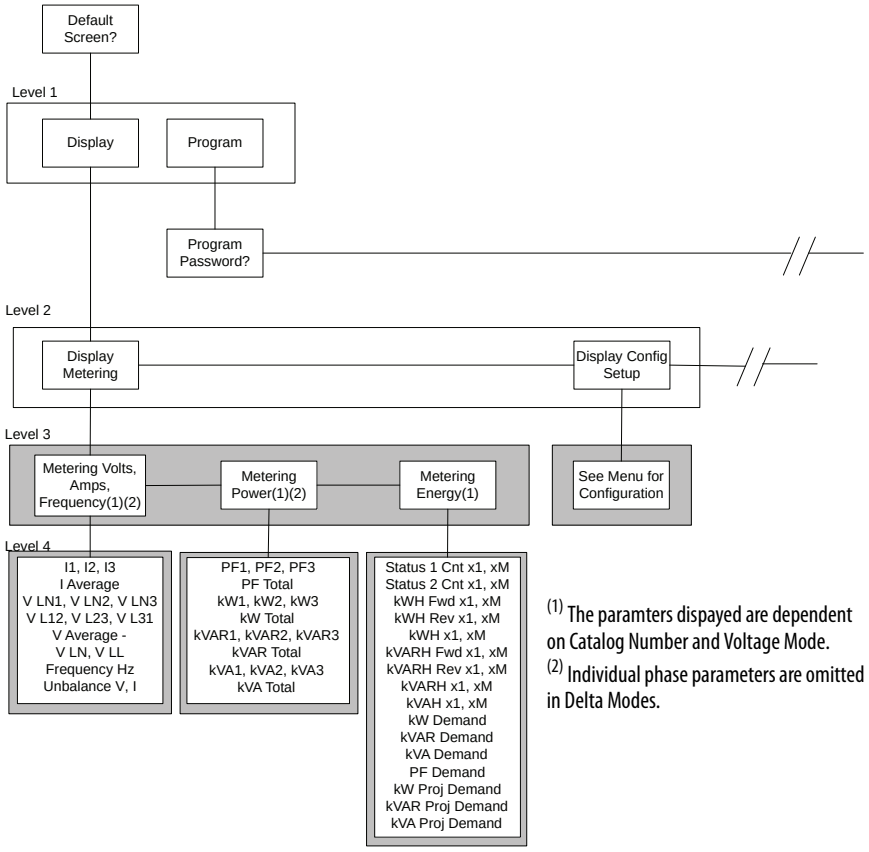
This diagram shows how to navigate in the display and configuration menu.

Figure 27 - Menu Navigation



LCD Screen Display and Configuration Menu Map

Figure 28 - Main Menu, Page 1



(1) The paramters dispayed are dependent on Catalog Number and Voltage Mode.

(2) Individual phase parameters are omitted in Delta Modes.

Default Screen

The power monitor lets you select and navigate to a default screen. The default screen displays at startup and is displayed after the display has been dormant for approximately 30 minutes. To set the current screen as the default, press Enter and click Yes. If you're in another menu and want to get back to the default screen, continue pressing Escape until you are prompted To Default Screen? Click Yes to display the default screen.

Figure 29 - Main Menu, Page 2

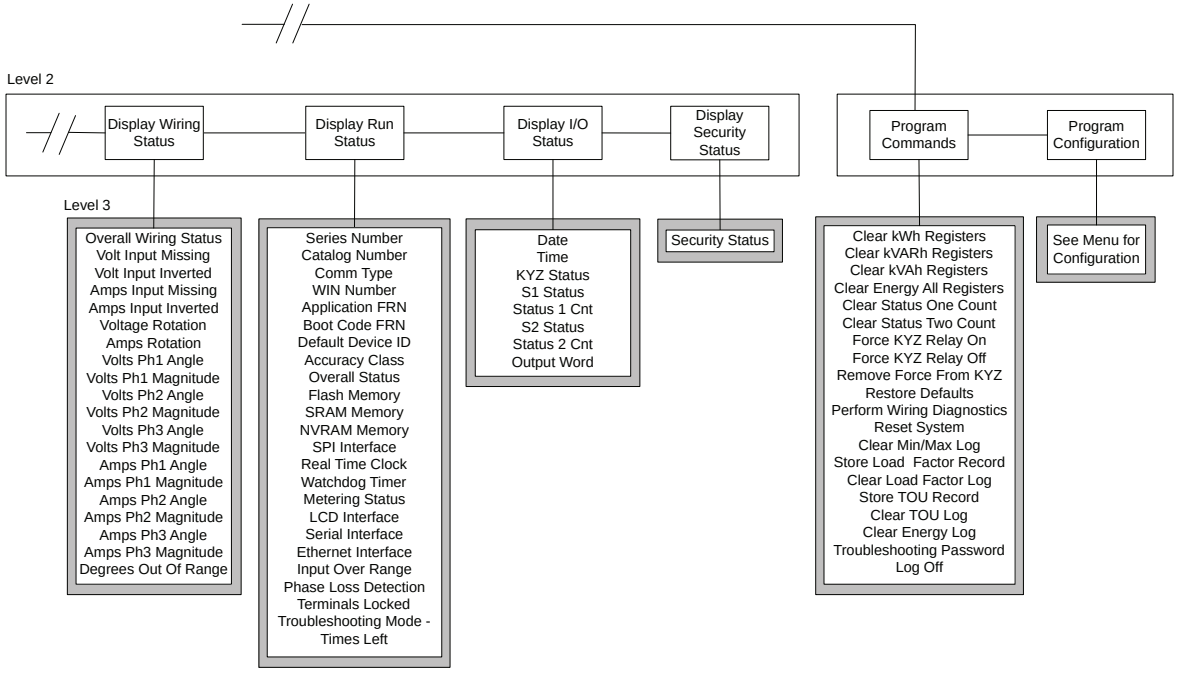
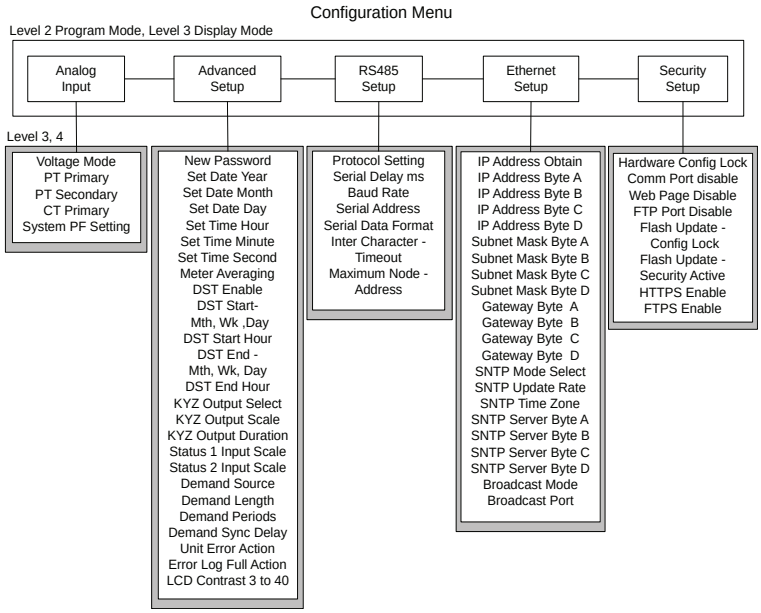


Figure 30 - Setup Submenu



Edit a Parameter

To edit a parameter, do the following:

- Press <up> or <down> to change the highlighted digit.
- Press <up> and <down> together to move the highlight cursor one place to the left, and press <up> or <down> to set the selected digit's value.

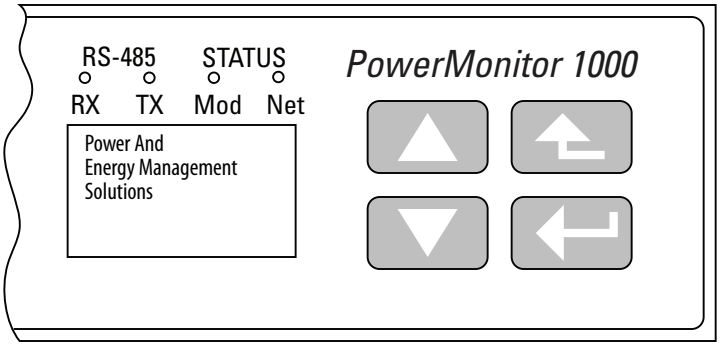
Continue in the same way until the correct value is entered then press <enter> when done.

Setup Example

This example steps through setting the unit date to demonstrate use of the display and buttons to navigate through the setup menu and make changes to parameters.

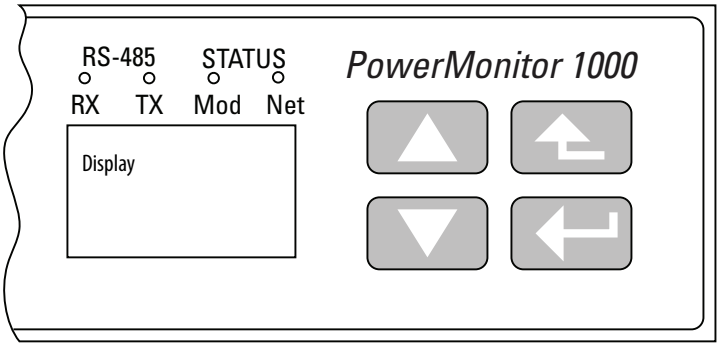
1. Navigate to the initial screen.

   The screen shown is the top level screen. If it is not present, press <escape> until it appears.



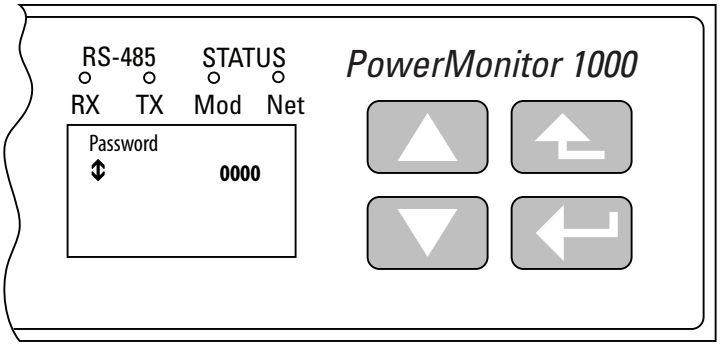
   If you press <escape> once too often, the To Default Screen? message appears. Press <escape> once more if this occurs.

2. Press <enter> and this screen appears.



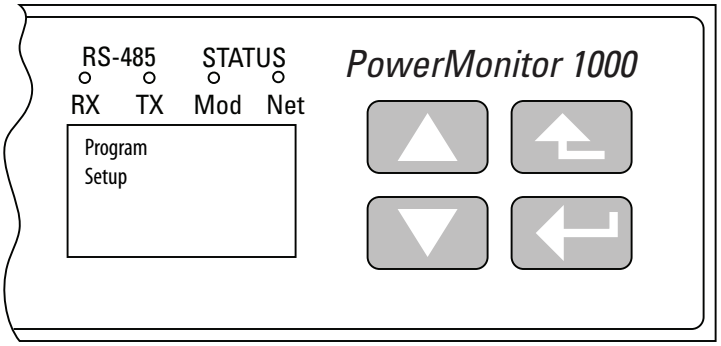
3. Press <up> or <down> once.

   Program appears in the display. Press <enter>.



4. Press <enter> if the password has not been changed from the default (0000).

   If the password has been changed, then enter the correct password.

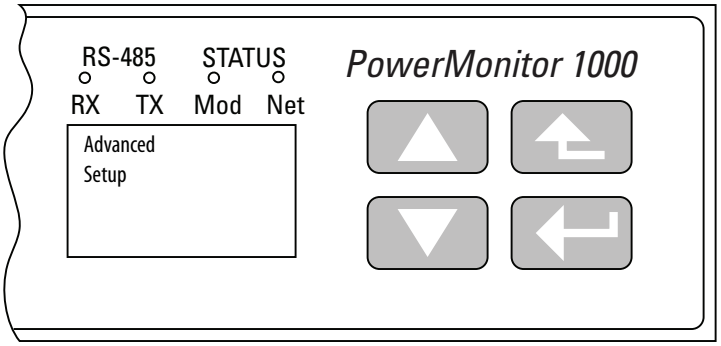


   When the correct password is entered, Program Setup appears in the display. The power monitor is now in Program mode.

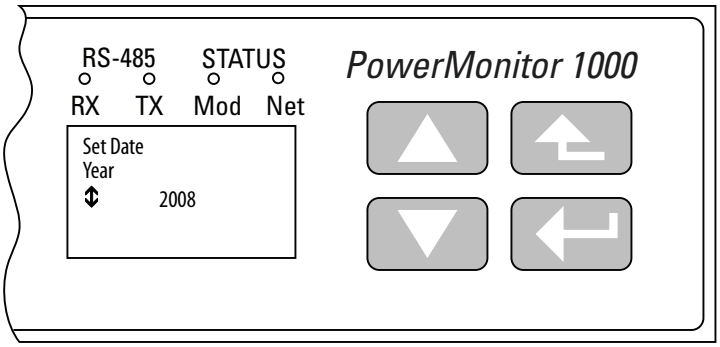
   If an incorrect password is entered, Invalid Password appears. Press any button to try again.

5. Press <enter>.

   Analog Input appears in the display. Press <down>.



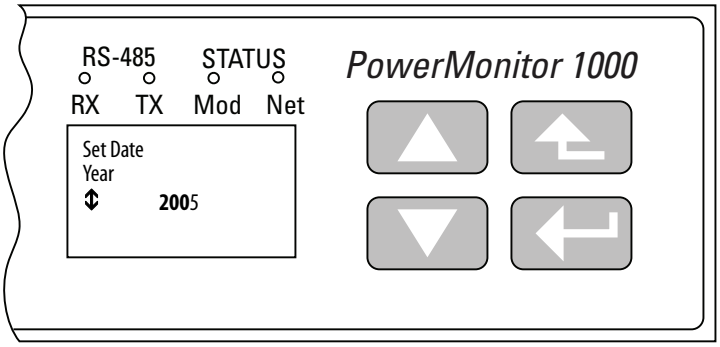
6. With Advanced Setup displayed, press <enter>, then press <down> until Set Date Year appears.



7. Press <enter> to change the value of the year.

   The power monitor is now in Edit mode, indicated by the presence of the highlight cursor. Change the year value and press <enter> to save it or <escape> to discard changes.

   See Edit a Parameter on page 41 if you need help with this.



8. Select the next item in the configuration menu by pressing <down>.

   Set the month in the same way.

Continue setting the remaining parameters in the same way.

- Navigate to the top menu display
- <enter> then <down> then <enter> to access the password screen
- Enter the correct password to access Program mode
- Navigate to the desired menu using <enter>, <up> and <down>
- <enter> selects a parameter for editing
- <up> or <down> increments or decrements the value of the highlighted digit
- <up> and <down> together move the highlight cursor
- <enter> saves your changes; <escape> discards them
- <escape> several times to the top menu to access Display mode

View Data with the Display

You can also view power monitor wiring diagnostics, metering, status and setup data using the display. To view data, select Display (instead of Setup) from the top menu and navigate through the menus as in the setup example. Press <enter> and <escape> to navigate into and out of submenus and <up> and <down> to select items within a submenu. Display mode does not permit you to change any parameter. Metering data available depends on the model of your power monitor.

Use Terminal Emulation Software for Setup

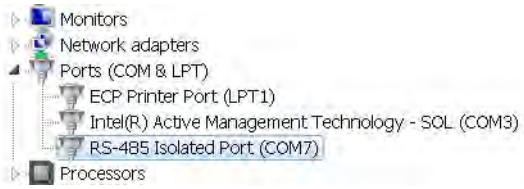
The PowerMonitor 1000 unit can be set up by using the RS-485 port for ASCII communication with terminal emulation software. HyperTerminal is no longer included with the Microsoft Windows operating system, however, a number of terminal emulation software options are available. The steps described here utilize PuTTY software, an open-source application that can be downloaded and used at no charge. Other terminal emulation software, such as HyperTerminal Private Edition and TeraTerm, can also be used.

Browse this link for more information or to download PuTTY software: http://www.chiark.greenend.org.uk/~sgtatham/putty/

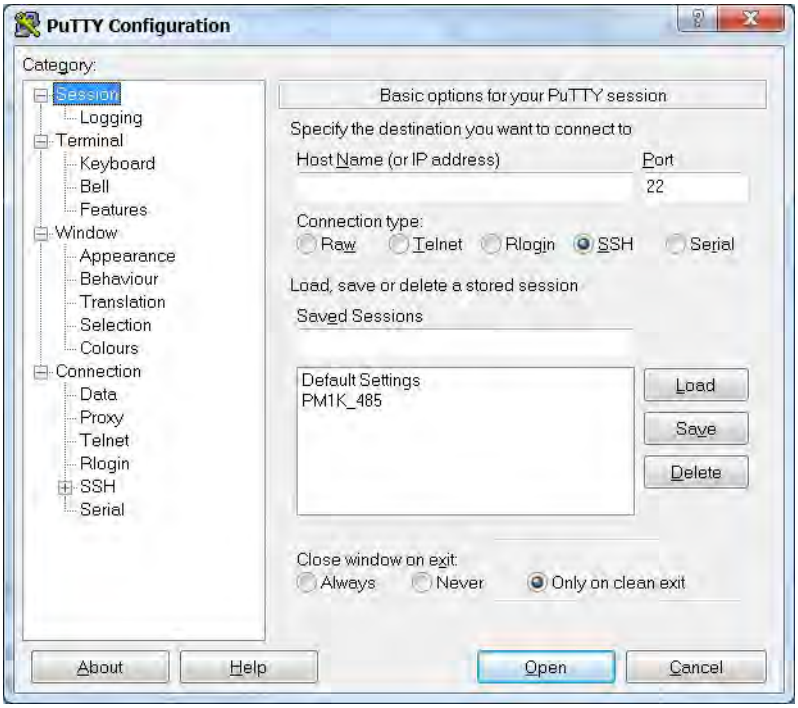
Follow these steps to use PuTTY software for setup. If you use a different software, the steps to follow can be different.

1. Connect the unit to your computer with a serial cable or adapter.

   Refer to RS-485 Point-to-point Typical Wiring on page 33. If you use an RS-485 adapter that installs a virtual COM port, open Device Manager to determine the port assignment.



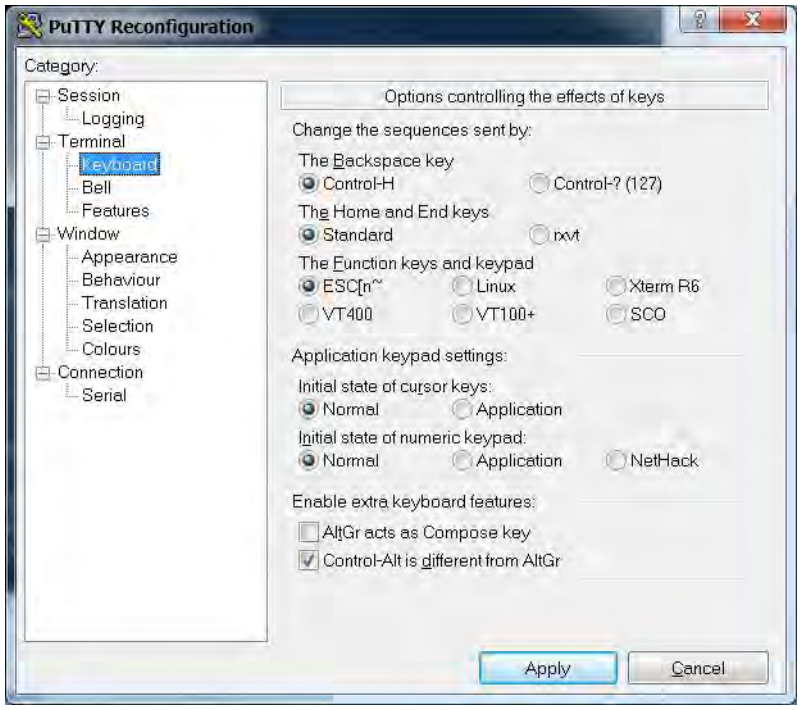
2. Launch PuTTY software.



3. When the software loads, select the following in the Session page:
   - Connection type: Serial
   - Serial line: COM1, another available port, or the virtual port assigned by your communication adapter
   - Connection speed: 38400

4. Select the Keyboard page and make the following change.

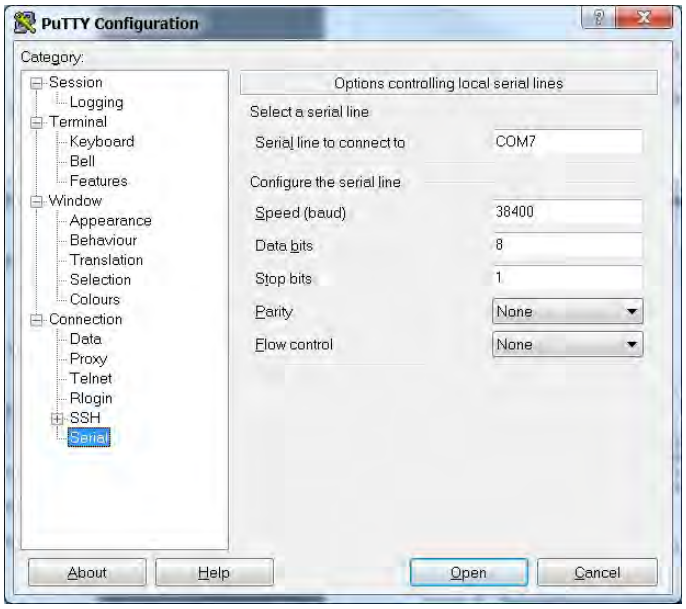
   The Backspace key: Control-H



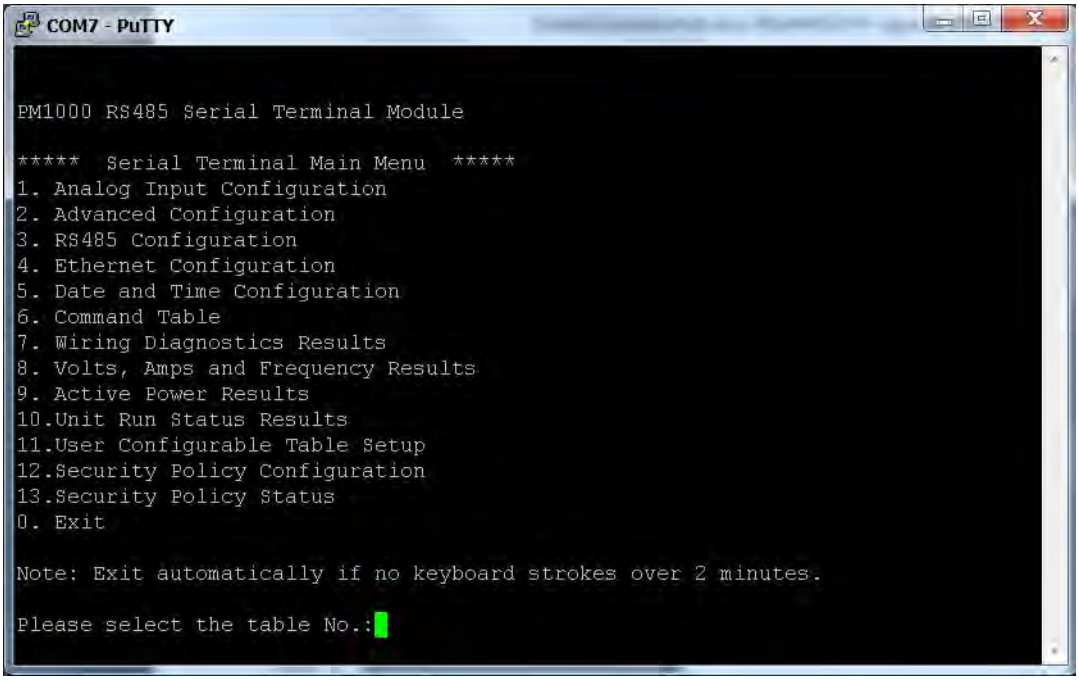
5. Select Serial and make the following changes:
   - Data bits: 8
   - Stop bits: 1
   - Parity: None

     TIP If the port has been used for DH-485 communication, set Parity to Even.

   - Flow control: None



6. Click Open.
7. When the program window opens, press Enter three times to bring up the menu.


COM7 - PuTTY
PM1000 RS485 Serial Terminal Module
***** Serial Terminal Main Menu *****
1. Analog Input Configuration
2. Advanced Configuration
3. RS485 Configuration
4. Ethernet Configuration
5. Date and Time Configuration
6. Command Table
7. Wiring Diagnostics Results
8. Volts, Amps and Frequency Results
9. Active Power Results
10.Unit Run Status Results
11.User Configurable Table Setup
12.Security Policy Configuration
13.Security Policy Status
0. Exit
Note: Exit automatically if no keyboard strokes over 2 minutes.
Please select the table No.:

If the menu does not appear, check that the wiring is correct, that the adapter (if used) and its driver software is installed, and that the port is not in use by another application.

8. To select a menu item, type the number of the menu item, and press Enter.

   In a submenu, the power monitor presents parameters one at a time.

9. To change parameter values, enter the Table Password as the first parameter.

   To enter the password, backspace to delete the -1 and enter the correct password.

   TIP The Table Password is used here whether or not security is enabled.

   To view the existing settings without making changes, leave the password unchanged.

10. Press Enter to accept the password and present the next parameter.
11. To change any parameter, backspace over the displayed parameter and enter the new value.

12. Press Enter to save and move to the next parameter.

    The software displays 'Write operation finished successfully' after the last parameter is entered. This indicates the setup parameters are written to the power monitor. Other messages that are displayed include the following:

    - 'Write error occurs with element 0' - indicates that the correct Table Password was not entered
    - 'Write error occurs with element n' - indicates that the value entered for parameter n is outside the acceptable range of values

    After the message, the prompt appears:

    'Edit... Configuration Table again?

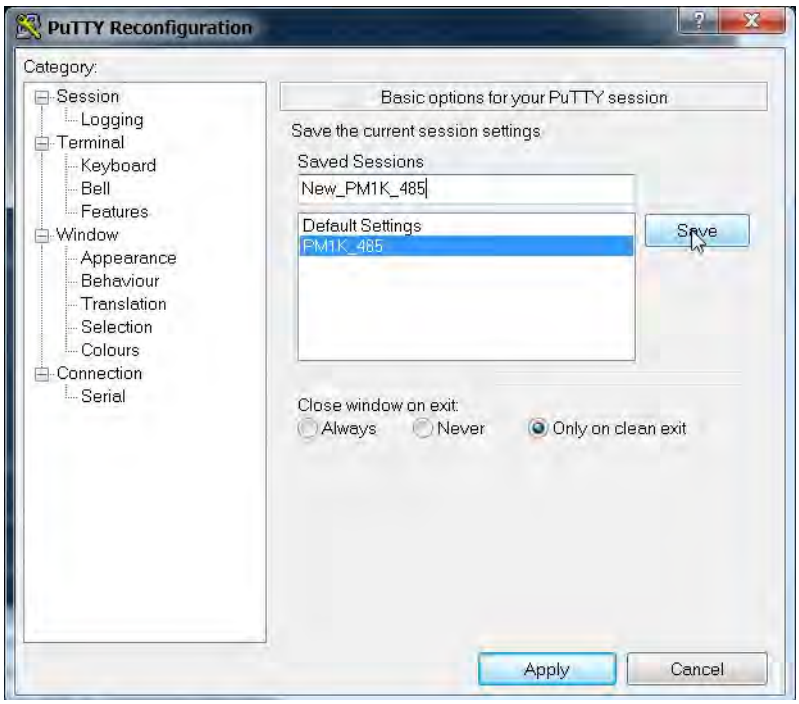
    'Type Y for more editing, otherwise type any other key to exit.: N'

13. Type Y and press Enter to review or edit the selected setup parameters, or press Enter to return to the main setup menu.

    The terminal session exits the setup menu after two minutes of inactivity, and displays 'Quit RS485 Serial Terminal Mode'.

14. To resume, press Enter three times.

15. To save the PuTTY connection to the PowerMonitor 1000 unit, select Change Settings ... from the PuTTY menu and save the setup in the Session page.



Use Communication to Set Up

You can set up the unit by using a programmable controller with user logic to write configuration tables using explicit messaging. Refer to the section on Explicit Messaging on page 87, for detailed information on configuring the unit through communication with a programmable controller or custom software application.

Set-up Menus

Whichever set-up method you select, set-up parameters are organized in several set-up menus.

- Analog input setup
- Advanced setup
- RS-485 communication setup
- Optional Ethernet network communication setup
- Date and time setup
- User Configurable Table Setup (except BC3 model)
- Security Policy Configuration

Notes:

PowerMonitor 1000 Unit Features

This section describes in detail the functions of the power monitor. Each function includes information on set-up menus and parameters used to control its operation.

Security

The PowerMonitor 1000 Series B product operates in two modes. In Operational mode, the product performs the everyday functions, but setup changes are not permitted. In Administrative mode, the product continues to perform as though in Operational mode, however, changes in setup and security policy are permitted, and commands can be executed.

Administrative mode access is governed by a user-configured security policy. A Policy Holder, defined during initial commissioning of the product, administers security policy. Refer to First Run Web Page on page 16, for more details.

Security Configuration Selections

The Policy Holder can create security user logins and make selections that control administrative mode access.

- The Policy Holder can disable Web Page Access Security and CIP Explicit Message Security (disabled is the default setting for these parameters). In this case, the PowerMonitor 1000 unit operates the same as Series A units, by using a Table Password to enable changes to setup or execute commands.

IMPORTANT	The security policy does not apply to the LCD display and keypad, nor to the RS-485 communication options, including DF-1, DH-485, Modbus RTU, and ASCII (terminal emulation). These methods retain the use of the Table Password for protecting against unauthorized changes to the setup.

  If the Table Password is active, there are two ways to gain write access:
  - An entire table including a valid Table Password is written.
  - A valid Table Password is written to the Single element password write table, which then enables single element writes until 30 minutes elapses without a write.

- The Policy Holder can enable Web Page Security. In this case, the Policy Holder or an Admin user must be logged-in to change configuration or execute commands by using the web page. The Table Password is no longer active, its entry field in web pages is disabled (grayed-out) and its value is ignored by the product.
- The Policy Holder can enable CIP Explicit Message Security. In this case, a controller or other CIP or Modbus/TCP client must log in to change configuration or execute commands by writing to data tables. The Table Password is no longer active, and when it is written to the unit, its value is ignored. This option applies to both EtherNet/IP and Modbus/TCP communication using the Ethernet port.
- The security policy restricts only write access to the power monitor configuration and command tables. No login is required by a user or an application to read data, including data logs.

Security User Types

The Policy Holder can establish user logins. Two User Types are available:

- Admin - When Web Page Security is enabled, the Admin user type permits you to log in by using the web interface. After you log in, you can change the unit setup, edit the security policy, create, delete and edit users, and issue commands for the unit to process.
- Application - When CIP Explicit Message Security is enabled, the Application user type permits an application, such as a programmable controller or operator terminal, to write data using explicit messages to change the unit setup and issue commands.

At most, one Admin user and one Application user can be logged in at the same time. Each user type has access to change the unit setup and execute commands.

Managing Users

The Policy Holder can use the web Security page to create additional Admin or Application users while logged in. Once an Admin user is created, the Admin user can also create additional users of either user type. User names and passwords are ASCII strings with a maximum length of 32 characters.

The Policy Holder is created in the first run web page on initial commissioning of the unit and cannot be edited or deleted. If the Policy Holder credentials (user name and password) are lost or forgotten, the unit must be reset to factory defaults if Policy Holder access is required.

Logging In

With Web Page Security enabled, to edit the unit setup or execute commands, an Admin user or the Policy Holder must log in. An Application user is not permitted to log in to the web page.

1. Log in by using one of two ways:
   - Click the Log in link in the web page header, enter the user name, password, and click Log In.
   - Open the Security folder, click the Security link, enter the user name, password, and click Log In.
2. With CIP Explicit Message Security enabled, to edit the unit setup or execute commands, an application must write the user name (with NULL characters appended to establish a 32-character string length) to the Security User Name data table.
3. Then, within 30 seconds, write the 32-bit password (also with NULL characters appended to establish a 32-character string length) to the Security Password data table to log in.

   Only an Application type user can use this method.

TIP An example of writing the application user name and password for EtherNet/IP is provided in Chapter 6, Explicit Messaging.

Logging Out

There are two ways to log out from the web page:

- Click the Log out link in the web page header.
- Open the Security folder, click the Security link, and click Log Out.

An application can log out by writing a value of 8 to Command Word 2 in the Command data table.

Users and applications are automatically logged out after 30 minutes without write activity.

Additional Security Policy Configuration

A number of additional security policy options are available and can be accessed in the web Security Policy Configuration page or the Security Policy Configuration data table.

Parameter	Description	Default	Range	User Setting
Hardware Configuration Lock	Defines behavior when Configuration Lock jumper is applied between terminals CF1 and CF2 0 = Lock Analog Input configuration, energy configuration parameters, security policy configuration and command word 1 parameters including unit reset. 1 = Lock Analog Input configuration, energy configuration parameters, security policy configuration and command word 1 parameters including unit reset, lock Ethernet configuration.	0	0…1	
Communication Port Disable	0 = All available communication ports enabled 1 = Ethernet port disabled 2 = RS485 port disabled	0	0…2	
Web Page Disable	0 = Enable web page access 1 = Disable web page access	0	0…1	
FTP Port Disable	0 = Enable ftp port access 1 = Disable ftp port access	0	0…1	
Flash Update Disable Configuration Lock	0 = Allow firmware flash update when configuration is locked by hardware. 1 = Disable firmware flash update when configuration is locked by hardware.	0	0…1	
Flash Update Disable Security Active	0 = Allow firmware flash update when security is enabled. 1 = Disable firmware flash update when security for CIP is enabled. 2 = Disable firmware flash update when security for web page is enabled. IMPORTANT: Under setting 2, the CIP Reset Service is active and can still be used to reset the PowerMonitor 1000 unit. Enable security for CIP to block CIP Reset Service Messages. 3 = Disable firmware flash update when security for CIP or web page is enabled. IMPORTANT: If Security is enabled and the Admin Login source IP address and the Flash Source IP address are the same, then Flash Update is allowed.	0	0…3	
HTTPS Enable[1]	0 = HTTPS disable. 1 = HTTPS enable.	0	0…1	
FTPS Enable[2]	0 = FTPS disable. 1 = FTPS enable.	0	0…1	

(1) If enabled, you must use a browser capable of supporting SSL 3.0 (TLS 1.0), and enter the unit IP address with an 'https://' prefix.

(2) If enabled, you must use an ftp client capable of supporting SSL 3.0 (TLS 1.0).

Analog Input Setup

This feature applies to all models.

Setup

The power monitor calculates metering results based on scaled voltage and current inputs. Setting up the analog inputs is necessary to obtain accurate, properly scaled metering results.

Parameter	Description	Range	Default	User Setting
Voltage mode	Must match the external electrical system and how it is wired to the PowerMonitor voltage and current input terminals. Refer to the wiring diagrams. 0 = Direct Delta 1 = Open Delta 2 = Wye 3 = Split Phase 4 = Demo, simulated results 5 = 1PT1CT-LL 6 = 1PT1CT-LN	0…6	2	
PT primary	The primary value of the PT ratio (Pri:Sec) indicating the nominal voltage present at the high-end of the transformer. For direct connect, set the PT ratio to any valid 1:1 ratio (for example, 480:480).	1.00… 50,000	480	
PT secondary	The secondary value of the PT ratio (Pri:Sec) indicating the nominal voltage present at the low-end of the transformer.	1…600	480	
CT primary	The primary value of the CT ratio (Pri:5) indicating the nominal current present at the high-end of the transformer. The nominal CT rated current is 5 A.	5…50,000	5	
System PF setting	Select range corresponding to expected power factor.	0 = Lead (-97…89) 1 = High (-85…98) 2 = Low (-52…-95)	2 = Low	

Related Functions

- Wiring diagnostics
- Configuration lock

Wiring Diagnostics

The power monitor performs wiring diagnostics on command to detect and report wiring errors. Wiring diagnostics operate in any wiring mode except Demo and 1PT 1CT modes, provided that measured current is at least 10% of the CT primary parameter in Analog Setup. You can select from three ranges of system power factor to improve wiring diagnostics accuracy.

This function applies to all models. The BC3 model provides a limited results set.

Diagnostic Parameters

When a Perform wiring diagnostics command is given, the power monitor calculates and returns the results. To reduce the likelihood of erroneous or misleading wiring diagnostic data, interim results of multiple tests must agree before results are displayed. Wiring diagnostic results return to their default status approximately five minutes after the command is issued.

Wiring status:

- Pass - system wiring is correct for the voltage mode and power factor selections.
- Failed - system wiring is incorrect. Refer to voltage and current input status for additional information.
- Input Low - measured current is below 10% of full scale.
- Disabled - the power monitor is in Demo or 1PT 1CT wiring mode.
- Waiting Command - five minutes have elapsed since the most recent command.
- Out of Range - measured phase angles are outside the range of the selected system power factor.
- Voltage or current input missing (input below the metering threshold) or inverted (reverse polarity, 180 degrees out of phase)
  - -1 — Test not run; see wiring status for reason.
  - 0 — Pass, all inputs present / correct polarity.
  - 1 — Phase 1 missing / inverted.
  - 2 — Phase 2 missing / inverted.
  - 3 — Phase 3 missing / inverted.
  - 12 — Phase 1 and 2 missing / inverted.
  - 13 — Phase 1 and 3 missing / inverted.
  - 23 — Phase 2 and 3 missing / inverted.
  - 123 — All 3 phases missing / inverted.
- Voltage rotation
  - -1 — Test not run; see wiring status for reason.
  - 123 — Forward phase rotation (ABC).
  - 132 — Reverse phase rotation (ACB).
  - 4 — Invalid phase rotation (2 inputs wired with same phase).
- Current rotation, referenced to voltage Phase 1
  - -1 — Test not run; see wiring status for reason.
  - 123 — Forward rotation (ABC).
  - 231 — Forward rotation, 120 degrees displaced (BCA).
  - 312 — Forward rotation, 240 degrees displaced (CAB).
  - 132 — Reverse rotation (ACB).
  - 213 — Reverse rotation, 120 degrees displaced (BAC).
  - 321 — Reverse rotation, 240 degrees displaced (CBA).
  - 4 — Invalid phase rotation (2 inputs wired with same phase).

Forward phase rotation is not required to pass wiring diagnostics. Before changing wiring connections, refer to both the voltage / current rotation and voltage/current inverted status to select the correct analog input.

Magnitude and Phase Angle

The power monitor continually returns voltage and current magnitude and phase angle data. This data can be used to construct a phasor diagram, and in addition to the diagnostics parameters, to troubleshoot wiring issues. The following exceptions apply.

- Magnitude data is not returned by the BC3 model
- Current phase angle 2 always returns 0 in open-delta wiring mode

TIP The Troubleshooting mode of the power monitor lets you view magnitude data.

Please refer to Troubleshooting Mode on page 58.

Phase angles are consistent with the four-quadrant power metering diagram.

Refer to Power Metering on page 63.

Setup

Basic analog setup is required. In addition, a system power factor must be selected. The ranges are as follows:

- Low (52...95% lag, default setting)
- High (85 lag ...98% lead)
- Leading (97 lag ...89% lead)

Results

Wiring diagnostics results can be viewed by using the following methods:

- Web interface
- LCD screen (except for BC3 model)
- Communication
- RS-485 terminal emulation software

Commands

- Perform wiring diagnostics
- Test wiring connections (LCD screen menu)

Troubleshooting Mode

Troubleshooting mode lets you enter a password-protected command that makes available all metered parameters for troubleshooting purposes. Troubleshooting mode does not change the data log support.

TIP This mode does not apply to the 1408-EM3 because this meter already has all of the parameters available.

RS-485 Communication

This function applies to all models.

Setup

Your power monitor is set up to communicate via its RS-485 port using a default set of parameters when you first apply power.

Parameter	Description	Range	Default	User Setting
Protocol Setting		DF1 Half-duplex Slave DF1 Full-duplex Modbus RTU Slave Auto Sense DH485	DF1 Full-duplex	
Delay(1)	Time between receiving a request and transmitting a response	0…75 ms	10 ms	
Baud Rate	Communication bit rate per second	1200, 2400, 4800, 9600(2), 19.2k(2), 38.4k, 57.6k	38.4k	
RS-485 Address	Uniquely identifies the power monitor on a multi-drop network	1…247 0…31(3)	Unit ID number	
Data Format	Data bits / stop bits / parity	8 / 1 / none 8 / 1 / even(3) 8 / 1 / odd	8 / 1 / none	
Inter Character Timeout(1)	Minimum delay between characters that indicates the end of a Modbus message packet	0…6553 ms	0 = 3.5 character times	
Max Node Address(3)		1…31	31	

(1) Delay, Inter Character Timeout parameters have no effect on DH485 protocol

(2) The baud-rate setting for DH485 must be 9600 or 19.2 k

(3) DH485

DH-485 protocol is supported in firmware FRN 2.0 and higher. If DH-485 is selected, the data format is automatically set to 8 / 1 / even. Recommended data rates for DH-485 are 9600 and 19.2k.

Error checking method is Cyclic Redundancy Check (CRC). All devices on a multi-drop RS-485 network must be set at the same data rate and each must be assigned a unique network address.

ASCII protocol used with terminal emulation software is always available, regardless of the protocol selection.

Optional Ethernet Network Communication

The power monitor supports simultaneous operation of the optional Ethernet network and serial ports.

This feature applies to all models with catalog numbers ending in -ENT.

The Ethernet network port supports 10 or 100 Mbps data rate, half-duplex, or full-duplex.

Setup

The Ethernet network port is set up with a default IP address and gateway using a common auto-configuration addressing scheme. The default address simplifies the task of making an initial connection to the unit from a personal computer with a compatible Class B IP address.

Parameter	Description	Range	Default	User Setting
IP address bytes 1…4	Unit IP address in format aaa.bbb.ccc.ddd	0…255	192.168.254.x (x is the unit's ID)	
Subnet mask bytes 1…4	Subnet mask in format aaa.bbb.ccc.ddd	0…255	255.255.255.0	
Gateway IP address bytes 1…4	Gateway IP address in format aaa.bbb.ccc.ddd	0…255	192.168.254.1	
SNTP setup	See Date and Time Functions setup. Includes: SNTP mode Update interval Time zone Time server IP address			

The power monitor operates with a fixed IP address that uniquely identifies it on the network. An IP address of 255.255.255.255 is not permitted. We recommend that you set up the unit with fixed Ethernet addressing, however, the unit does support DHCP auto-addressing.

IMPORTANT The IP address for your power monitor must not conflict with the IP address of any other device on the network. Contact your network administrator to obtain a unique IP address, subnet mask, and default gateway address for your unit.

Ethernet Network Addressing

The IP address is a 32-bit binary number, which consists of the network address (NetID) and the machine address (HostID). The Subnet mask defines the boundary between the NetID and HostID and each 0 represents the HostID.

Table 3 - Ethernet Network Addressing Example

IP address	(decimal):	192	1	1	207
	(binary):	11000000	00000001	00000001	11001111
Subnet mask	(decimal):	255	255	255	0
	(binary):	11111111	11111111	11111111	00000000
		----	Net ID	----	-Host ID-

In this example, the NetID is 192.1.1.0 and the HostID is 0.0.0.207. The relationship between NetID and HostID depends on the IP address class, the discussion of which is beyond the scope of this document (the example uses a Class C IP address). Devices on the same subnet can communicate directly; devices on different subnets can communicate with each other only through a gateway or router.

The Gateway IP address defines the address of the gateway or router on the unit's subnet that is used to route messages to other subnets for wide-area networking.

Energy Metering

This function applies to all models.

Metered Parameters

The power monitor calculates and returns the totalized energy values including the following:

- GWh forward, GWh reverse, and GWh net
- kWh forward, kWh reverse, and kWh net
- GVARh forward, GVARh reverse, and GVARh net
- kVARh forward, kVARh reverse, and kVARh net
- GVAh and kVAh

Each time the kWh value rolls over to zero the GWh value increments by one. The other pairs of values operate in the same way.

EXAMPLE	A large energy value could be displayed as 123,456,789,234.567 kWh where 123,456 is the GWh metering result and 789,234.567 is the kWh metering result.

Energy results (kWh, kVARh, and kVAh) roll over to 0 at a value of 9,999,999,999,999 or 10^{12}-1.

Setup

Only basic analog input setup is required for energy metering.

Results

Energy metering results can be viewed by using the following methods:

- Web interface
- LCD screen (except BC3 model)
- Communication

Energy results are not available via terminal emulation software.

Commands

The following commands are supported by the power monitor:

- Set GWh/kWh register
- Set GVARh/kVARh register
- Set GVAh/kVAh register
- Clear all energy registers

Related Functions

- KYZ output (except BC3 model)
- Energy log
- Configuration lock

Demand Metering

Demand is an electric power term that expresses the average energy usage over a period of time. The power monitor can be configured to measure demand using a fixed demand period or a sliding window. The demand period can be timed internally, synchronized to an external demand end-of-interval contact connected to the S2 status input, or synchronized using communication.

This function applies to catalog number 1408-EM3.

Metered Parameters

The power monitor calculates and returns the following demand values:

- Real power demand, kW
- Reactive power demand, kVAR
- Apparent power demand, kVA
- Demand power factor, percent lagging (-) or leading (+)
- Projected kW, kVAR, and kVA demand
- Demand interval elapsed time, minutes

Projected demand calculates a linear projection of demand at the end of a demand interval.

Demand power factor is calculated using the following formula.

kW Demand / kVA Demand

Setup

Demand metering requires basic analog input setup as well as demand calculation setup. Basic demand set-up parameters are found in the Advanced Setup menu. Network demand synchronization is available on units connected to an Ethernet network. Network-demand synchronization set-up parameters are found in the Ethernet communication set-up menu.

Parameter	Description	Range	Default	User Setting
Demand Source (advanced setup)	Selects the source of the demand end-of-interval (EOI) signal. 0 = Internal Timer 1 = Status Input 2 2 = Controller Command 3 = Ethernet Demand Broadcast Network-demand synch options are available only on units with an optional Ethernet network installed. • If Demand Broadcast Master Select is set to master then a Demand Source value of 0…2 selects the EOI source that is used to trigger the demand-synch master broadcast. • If Demand Broadcast Master Select is set to slave then a Demand Source value of 0…3 selects the EOI source.	0…3	0	
Demand Period Length (advanced setup)	Specifies the desired period for demand calculations. When set to 0, there are no projected demand calculations. If the internal timer is selected (Demand Source = 0), a setting of 0 turns the demand function off.	0…99 min	15 min	
Number of Demand Periods (advanced setup)	Specifies the number of demand periods to average together for demand measurement. This parameter is used for sliding window demand calculations. For example, for a 30 minute sliding-window, demand period length = 2 minutes and number of demand periods = 15.	1…15	1	
Forced Demand Sync Delay (advanced setup)	If demand source 0 and demand period length 0 then this parameter determines how long the unit waits for an EOI pulse, command, or broadcast after the expected control pulse has not been received. If the EOI signal is not received before the waiting period expires, a new demand period starts and a record is entered in the status log. Special case: 0 = Wait forever	0…900 s	10	
Demand Broadcast Master Select (Ethernet setup)	0 = Slave, the unit uses its selected demand source to calculate demand. If demand source = 3 (Ethernet demand broadcast) the unit listens to the selected-broadcast port number for a broadcast from the demand-sync master unit. 1 = Master, the unit broadcasts an EOI broadcast to the selected-UDP port number when the selected demand source detects an EOI event.	0…1	0	
Broadcast Port Number (Ethernet setup)	Specifies the listening or broadcast port for the UDP Ethernet-demand broadcast message.	300…400	300	

Results

Demand metering results can be viewed by using the following methods:

- Web interface
- LCD display (except BC3 model)
- Communication

Demand results are not available via terminal emulation software.

Commands

- Controller command (EOI signal)

Related Functions

- Status inputs
- Time of use log
- Configuration lock

Power Metering

This function applies to all models.

Metered Parameters

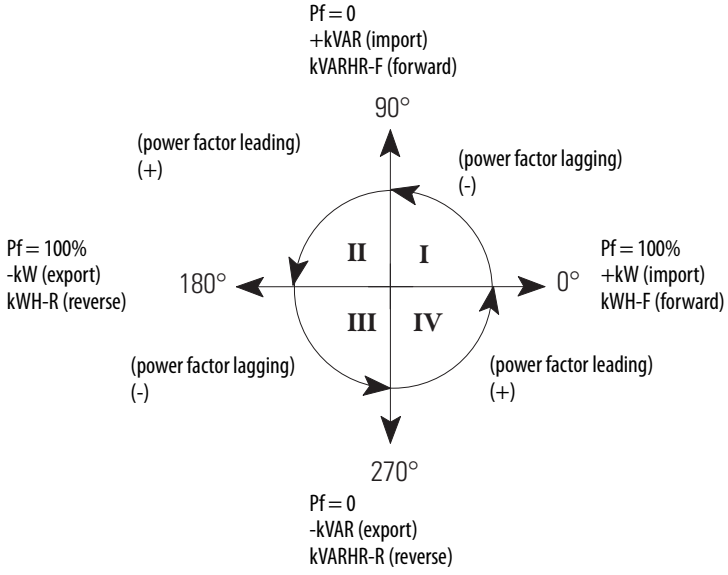
The power monitor calculates and returns four-quadrant power measurements including these:

- L1, L2, L3 and Total True Power Factor, percent lagging (-) and leading (+)
- L1, L2, L3 and Total Real Power, kW
- L1, L2, L3 and Total Reactive Power, kVAR
- L1, L2, L3 and Total Apparent Power, kVA

Only total three-phase power results are provided when Direct Delta or Open Delta wiring modes are selected.

The Magnitude and Direction of Power Quantities chart indicates the relationship between the magnitude and direction of the power quantities and the numeric signs used by the power monitor.

Figure 31 - Magnitude and Direction of Power Quantities



Setup

Only basic analog-input setup is required for power metering.

Results

Power metering results can be viewed by using the following methods:

- Web interface
- LCD screen (except BC3 model)
- Communication
- RS-485 terminal emulation software

Related Functions

- Metering result averaging
- Configuration lock

Voltage, Current, and Frequency Metering

This function applies to catalog numbers 1408-TS3 and 1408-EM3.

Metered Parameters

The power monitor calculates and returns voltage, current, and frequency measurements including these:

- L1, L2, L3, and Average Current, A
- L1-N, L2-N, L3-N, and Average L-N Voltage, V
- L1-L2, L2-L3, L3-L1, and Average L-L Voltage, V
- Frequency
- Percent Current Unbalance
- Percent Voltage Unbalance

Line-to-neutral voltage results are not provided for Delta and Open Delta wiring modes.

Voltage and current unbalance are calculated according to the following formula.

$$\frac{\text{Maximum Deviation from Average} \times 100}{\text{Average}}$$

Setup

Only basic analog-input setup is required for voltage, current, and frequency metering.

Results

Voltage, current, and frequency metering results can be viewed by using the following methods:

- Web interface
- LCD screen (except BC3 model)
- Communication
- RS-485 terminal emulation software

Related Functions

- Metering result averaging
- Configuration lock

Date and Time Functions

The power monitor internal clock and calendar is used in demand metering and data logging functions. A number of user-selectable options are available for synchronizing and controlling the internal clock and calendar.

This function applies to all models.

Date and Time Parameters

- Date: Year, Month, Day
- Time: Hour, Minute, Seconds, Hundredths

Basic Setup

Basic setup is done using the date and time setup menu.

TIP In the LCD screen, date and time are included in the Advanced Setup menu.

Parameter	Range	Default
Date: Year	2001…2100	2005
Date: Month	1…12	1
Date: Day	1…31	1
Time: Hour	0…23	0
Time: Minute	0…59	0
Time: Seconds	0…59	0
Time: Hundredths	0…99	0

Daylight-saving Time Setup

Daylight-saving time (DST) setup is done in the Advanced Setup menu. If DST is enabled, the power monitor internal clock advances by one hour on the start date and hour specified, and is set back by one hour on the return date and hour specified. The defaults represent the common DST start and return date/times in use in the United States in 2006. The DST function also adjusts the network-time synch offset when used.

Parameter	Description	Range	Default	User Setting
Use DST Correction	0 = Disables DST 1 = Enables DST	0…1	0	
DST Month/ Week/Day Start	Format: MMWWDD Month: 01 = January…12 = December Week: 01 = 1st week…05 = Last Week Day of Week: 01 = Sunday…07 = Saturday	010101… 120507	030201 March, 2nd, Sunday	
Hour of Day Start		0…23	2 (2 am)	
Return from DST Month/ Week/Day	Format same as start date	010101… 120507	110101 November, First, Sunday	
Hour of Day End		0…23	2 (2 am)	

Network Time Synchronization

Network time synchronization is available only on units equipped with the optional Ethernet network. Set-up parameters are found in the Ethernet communication set-up menu. The power monitor updates its time from a simple network time protocol (SNTP) server or an anycast group of SNTP servers, depending on setup parameter values. Network-time synchronization set-up parameters are found in the Ethernet communication set-up menu.

Parameter	Description	Range	Default	User Setting
SNTP Mode Select	0 = Disable 1 = Unicast – Specify the IP address of a unicast SNTP server. 2 = Anycast mode – Specify the broadcast IP address of a SNTP anycast group.	0…2	0	
SNTP Update Interval	Defines how often the time is updated from the SNTP server.	1…32766 minutes	300	
Time Zone Select	There are 32 available time zones.	0…32	7 (Eastern Time)	
Time Server IP Address	Unicast server or anycast group IP address in format aaa.bbb.ccc.ddd.	0.0.0.0… 255.255.255.255	0.0.0.0	

See Time Zone Information on page 119.

Related Functions

- Demand metering
- Data logging

Energy Log

The energy log is one of five data logs where the power monitor records metering and status data. Data logging setup is performed using optional FactoryTalk EnergyMetrix RT software via communication.

Refer to the FactoryTalk EnergyMetrix user manual, publication FTEM-UM002 for information on the software.

This function applies to all models.

Logged Parameters

Energy log records contain a date/time stamp and the metering parameters listed below.

Metering Parameter	BC3	TS3	EM3
Status Input 1 Scaled Count		•	•
Status Input 2 Scaled Count		•	•
Real Energy Net, GWh / kWh	•	•	•
Reactive Energy Net, GVARH / kVARh	•	•	•
Apparent Energy Net, GVAh / kVAh	•	•	•
Real Power Demand, kW			•
Reactive Power Demand, kVAR			•
Apparent Power Demand, kVA			•
Demand PF, percent			•

Results

Energy log records can be accessed via communication or ftp. Refer to the Energy Results data table, page 136 for the content and format of the logging results.

Commands

- Clear energy log

Related Functions

- Energy metering, Demand metering
- Configuration lock

Min/Max Log

The power monitor records time-stamped minimum and maximum values for all real-time metering data (except for energy data).

This feature applies to all models.

Logged Parameters

The min/max log contains a record for each of the metering parameters listed below along with a date/time stamp corresponding to the minimum and maximum value recorded.

Metering Parameter	BC3	TS3	EM3
L1, L2, L3 and Average Current		•	•
L1-N, L2-N, L3-N and Average L-N Voltage		•	•
L1-L2, L2-L3, L3-L1 and Average L-L Voltage		•	•
Frequency		•	•
Percent Current Unbalance		•	•
Percent Voltage Unbalance		•	•
L1, L2, L3 and Total True Power Factor	•	•	•
L1, L2, L3 and Total Real Power, kW	•	•	•
L1, L2, L3 and Total Reactive Power, kVAR	•	•	•
L1, L2, L3 and Total Apparent Power, kVA	•	•	•
Real Power Demand, kW			•
Reactive Power Demand, kVAR			•
Apparent Power Demand, kVA			•
Demand PF, percent			•

Results

Min/max log records can be accessed via communication. Refer to the Min/Max Log Results data table, page 147 for the content and format of the logging results.

Commands

- Clear single min/max log record
- Clear min/max log

Related Functions

- Energy metering
- Demand metering
- Voltage, current and frequency metering
- Power metering

Load Factor Log

The power monitor maintains a 12-month record of demand and load factor. Load factor is average demand divided by peak demand and is a measure of load variability.

This function applies to catalog number 1408-EM3.

Logged Parameters

The load factor log consists of 13 records, an in-process record for the current month, and one record for the previous 12 months. The monthly records operate in a circular or FIFO fashion. On a user-selected day each month, the current record is pushed into the monthly record stack and cleared. Each record contains the following data:

- Real power demand, peak and average, kW
- Real power load factor, percent
- Reactive power demand, peak and average, kVAR
- Reactive power load factor in percent
- Apparent power demand, peak and average, kVA
- Apparent power load factor in percent

Results

Load factor log records can be accessed via communication. Refer to the Load Factor Log Results data table, page 147 for the content and format of the logging results.

Commands

- Store and clear current Load Factor Record
- Clear Load Factor Log

Related Functions

- Demand metering

Time of Use Logs

The power monitor maintains records of energy and demand organized by times of use you define. These records can be used for billing and cost allocation.

There are up to three time-of-use (TOU) logs, one for real energy and demand, one for reactive energy and demand, and one for apparent energy and demand. Within each log, energy consumption is recorded into off-peak, mid-peak, and on-peak categories. The EM3 model also records off-peak, mid-peak, and on-peak demand. The days and times that define the mid- and on-peak periods are user selectable. All times of use not defined as mid- or on-peak are considered off-peak.

This function applies to all models, however, demand data is included only in the EM3 model.

Logged Parameters

Each TOU log consists of 13 records, an in-process record for the current month, and one record each for the previous 12 months. The monthly records operate in a circular or FIFO fashion. On a user-selected day each month, the current record is pushed into the monthly record stack and cleared. Each record contains the following data:

- Net energy: off-peak, mid-peak, and on-peak
- Peak demand: off-peak, mid-peak, and on-peak (EM3 model only)
- Start and end date/time of the record
- Record number

Results

Time of use log records can be accessed only via communication. Refer to the Time of Use Log Results data tables, for the content and format of the logging results.

- Time of Use Log Results - Real Energy and Demand on page 148
- Time of Use Log Results - Reactive Energy and Demand on page 149
- Time of Use Log Results - Apparent Energy and Demand on page 150

Commands

- Store and clear current TOU Record
- Clear TOU Log

Related Functions

- Energy metering
- Demand metering

Unit Status Log

The Unit Status log records the date and time of changes made to the device and of external events. The Unit Status log consists of 50 records and operates in a circular or FIFO fashion. The Unit Status log cannot be cleared.

This function applies to all models.

Logged Events

- Configuration changed
- Clock set
- Relay output forced on or off (except BC3 model)
- Status input activated or deactivated (can be disabled) (except BC3 model)
- Status input counter 1 or 2 rollover or set (except BC3 model)
- Missed external sync pulse (EM3 model only)
- Energy register rollover or set
- Device power-up or power-down
- Self-test status

Results

Unit Status log records can be accessed only via communication. Refer to the Unit Status Log Results data table, page 138 for the content and format of the logging results.

Related Functions

- Log status input changes

Alarm Log

The Alarm log records the date and time of selected events. The alarm log consists of 50 records and operates in a circular or FIFO fashion. The alarm log cannot be cleared.

This function applies to catalog number 1408-EM3 only.

Logged Alarms

- Metering Alarms
  - Input over-range
  - Voltage channel loss
- Terminal lock
- KYZ output forced
- Status input activated / deactivated
- Energy register rollover
- Missed external demand sync

Results

Alarm log records can be accessed only via communication.

Related Functions

- Unit Status Log

I/O Functions

The I/O functions include Relay KYZ Output, Status Inputs, Configuration Lock Input, and Restore Defaults (BC3 model).

Relay KYZ Output

The KYZ output is a solid-state relay designed for low-power, long-life signaling operation. Its typical use is to provide a pulse output proportional to energy consumption to an external totalizer.

This function applies to catalog numbers 1408-TS3 and 1408-EM3 for energy pulse.

Operation

The KYZ output can operate in any of the following modes:

- Energy pulse operation with fixed pulse width or toggle
- Forced operation

Setup

KYZ-output set-up parameters are found in the Advanced Setup menu and are summarized in the table.

Parameter	Description	Range	Default	User Setting
KYZ Output Parameter	0 = Disable 1 = Wh Fwd 2 = Wh Rev 3 = VARh Fwd 4 = VARh Rev 5 = VAh	0…5	0	
KYZ Output Scale	The increase in value of the selected parameter that caused the output to change state	1… 100,000	1000	
KYZ Pulse Duration Setting	0 = toggle output 50…1000 = duration of output pulse, rounded to 10 ms	0 or 50… 1000	250 ms	

Commands

- Force KYZ Output On
- Force KYZ Output Off
- Remove Force from KYZ

Related Functions

- Configuration lock

Status Inputs

The power monitor has two self-powered (24V DC) status inputs. Two typical uses for status inputs are to totalize external pulse meters and to synchronize the demand end of interval (EOI).

This function applies to catalog numbers 1408-TS3 and 1408-EM3.

Operation

Each time status input 1 sees an off-to-on transition, the status input 1 scale factor is added to the status input 1 count. The count continues to increase, rolling over to zero at a value of 9,999,999,999,999 ($10^{12} - 1$). Status input 2 operates in the same fashion. Status input 2 counter operates whether or not the input is used for demand EOI synchronization.

Setup

The set-up parameters for pulse totalizing and scaling are in the Advanced Setup menu and are summarized in this table.

Parameter	Description	Range	Default	User Setting	Model				
					TR1	TR2	EM1	EM2	EM3
Status Input 1 Input Scale	When a status input sees an off to on transition, the status input count is increased by the scale factor.	1… 1,000,000	1				•	•	•
Status Input 2 Input Scale		1… 1,000,000	1				•	•	•

Setup for demand EOI synchronization is described in the Demand Metering section.

Metering Parameters

- Status 1 Count x1,000,000 and x1
- Status 2 Count x1,000,000 and x1

Commands

The following commands can be used to preset or reset the status input counters:

- Set Status 1 Count
- Set Status 2 Count

Related Functions

- Log status input changes
- Configuration lock

Restore Defaults

A user with administrative access to the power monitor (security policy login or Table Password) can issue a command to restore factory defaults.

IMPORTANT If present, the configuration lock jumper must be removed in order for a restore defaults command to succeed.

If administrative access is not available due to a lost password, there is no backdoor method to log in as an admin or policy holder. There are two methods to restore factory defaults without administrative access. When factory defaults are restored, the unit returns to an out-of-box condition. The out-of-box condition includes settings such as all security policy, metering configurations, network addressing.

1408-BC3 Model

Follow these steps to restore factory defaults.

1. Remove control power from the unit.
2. Working safely, remove the configuration lock jumper if present.
3. Working safely, install a jumper between the FD1 and FD2 terminals.
4. Apply control power for at least 30 seconds.
5. Remove control power.
6. Safely remove the jumper from FD1 and FD2.
7. Apply control power.
8. Starting with the first run web page on Ethernet or terminal emulation on RS-485, restore the unit configuration.
9. When setup is complete, safely reinstall the configuration lock jumper if previously installed.

1408-EM3 and TS3 Models

Follow these steps to restore factory defaults on a model with display and keypad.

1. If the configuration lock jumper is present, follow these steps:
   a. Remove control power.
   b. Safely remove the configuration lock jumper.
   c. Reapply control power.
2. Press and hold the up arrow and ESC keys together for 3 seconds.

   The unit resets as indicated by the POST sequence on the status indicators and restores to factory default settings.
3. Starting with the first run web page on Ethernet or terminal emulation on RS-485, restore the unit configuration.
4. When setup is complete, safely install the configuration lock jumper if previously installed.

Configuration Lock Input

Unauthorized changes to the power monitor setup are prevented when the configuration-lock input terminals, CF and CF1, are connected together.

This feature applies to the supported features in all models.

Operation

The following set-up parameters and commands are locked when the configuration lock is applied:

- Analog input setup menu: all parameters
- Advanced setup menu
- Metering result averaging
- Log status input changes
- KYZ setup
- Status input 1 and 2 input scale
- Demand setup
- Ethernet communication set-up menu
- Network demand setup
- Security policy setup

The following commands are prohibited when the configuration lock is applied:

- Set kWh, kVARh, kVAh register
- Clear all energy registers
- Set status 1 or 2 count
- Clear energy log
- Force KYZ output on, off, or clear force
- Restore factory defaults
- Reset power monitor system

Setup

No setup is needed.

Miscellaneous Functions

The power monitor includes a small number of miscellaneous functions that you can select. Set-up parameters of these functions are in the Advanced Configuration set-up menu.

Parameter	Description	Range	Default	User Setting
New Table Password	Select a new password if desired to help prevent unauthorized changes to the unit setup.	0…9999	0	
Metering Result Averaging	If enabled, metering results are averaged by using the previous eight cycles to smooth the results.	0 = Off 1 = On	1	
Log Status Input Changes(1)	If disabled, prevents routine status input changes from filling up the status log. Useful when a status input is used for pulse counting or demand EOI synch.	0 = Disable 1 = Enable	0	
Unit Error Action	Determines the unit's response to a hardware or firmware error. 0 = Halt, make status indicator solid red 1 = Reset the unit	0…1	1	
Software Error Log Full Action	Determines the unit response when a firmware failure is detected and the error log is full. 0 = Halt on error and wait for clear log command, make status indicator solid red 1 = Perform a firmware reset	0…1	1	

(1) Log status input changes parameter is not accessible from the LCD screen.

Commands

The power monitor offers the following commands. The power monitor Commands table can be accessed using the LCD screen, the HyperTerminal communication tool, the Web interface, or via communication.

Commands that do not apply to the power monitor model are ignored.

Command	Parameters	Action
Set kWh register	GWh / kWh forward GWh / kWh reverse	Presets forward and reverse energy values, resets if parameters = 0
Set kVARh register	GVARh / kVARh forward GVARh / kVARh reverse	
Set kVAh register	GVAh / kVAh forward GVAh / kVAh reverse	
Clear all energy registers	-	Resets all energy values
Set Status 1 count	New status 1 count	Presets or resets status input count
Set Status 2 count	New status 2 count	
Clear energy log	-	Clears all data from energy log
Force KYZ output on	-	Forces the KYZ output state, overrides automatic action
Force KYZ output off	-	
Remove force from KYZ	-	Restores automatic action of KYZ output as configured
Restore factory defaults	-	Clears all user-configured values from the setup menus to their factory default settings
Reset system	-	Warm reboot: Performs a power-on self test of the power monitor
Perform wiring diagnostics	-	Test the wiring connections
Clear min/max records	Min/max record number	Clears selected min/max record or all records if parameter = 0
Store and clear current load factor record	-	Simulates end-of-month push of in-process current month into the monthly load factor record stack
Clear load factor log		Clears all load factor log records
Store and clear current TOU record		Simulates end-of-month push of in-process current month into the monthly TOU record stack
Clear TOU log		Clears all TOU log records
Clear error log		Clears the error log

Related Functions

- Configuration lock

Communication

PowerMonitor 1000 Memory Organization

The power monitor memory is organized similarly to that of a PLC-5® or SLC™ 500 programmable controller. Data tables organize individual data items of similar function. For example, the analog input set-up parameters are grouped in one data table, and voltage, current, and frequency metering results in another.

Appendix A provides a detailed list of the power monitor data tables.

Data Table Addressing

Data tables can be addressed in several ways.

CSP Addressing

This is also known as PLC-5 style or PCCC addressing. Addresses are written in the form Axx:yy where A is a letter describing the function of the data table, xx is the table number, and yy is the element within, or offset into, the table. For example, F23:0 is the CSP address of the first element in the energy metering results table.

CIP Addressing

This is also known as DeviceNet addressing. Addresses are of the form Object:Instance:Attribute. CIP addressing allows addressing of an entire data table. In CIP addressing, the energy metering results table object 4 (Assembly object), instance 16 (energy results table) and attribute 3 (data).

Modbus RTU Addressing

The data tables can be addressed by a Modbus RTU master using Modbus register addressing. The Modbus protocol supports four types of data: Discrete Input, Coil, Input Register, and Holding Register. The power monitor supports Input Registers (read-only) with addresses in the 30000 range and Holding Registers (read-write or write only) with addresses in the 40000 range. Using the same example as above, the energy results table has a Modbus address range of 30401...30438

Data Table Access

Controllers and client applications can read or write single element, multiple elements or complete tables as permitted by the addressing selected.

Each data table's read/write access is listed in Appendix A.

Refer to Security on page 51 for information on how the power monitor is protected against inadvertent or unauthorized writes to data tables.

Data Table Data Format

The power monitor stores data in two basic formats.

- Integer, in which the 16-bit word can be represented by a signed integer value or a bit field
- Floating-point, in the 32-bit IEEE 754 format

Modbus input registers and holding registers are 16 bits long. Floating point values in the data tables are represented as big-Endian two-register arrays in IEEE-754 floating point format. The Modbus client application must be able to reassemble the two-word array into a valid floating-point value.

An example Modbus address for a floating-point value is 40101-2. Register 40101 holds the most significant bytes of the number and 40102 holds the lowest significant bytes.

Communication Command Summary

This section lists the commands supported by each communication network type.

Serial DF1 Full-duplex, DF1 Half-duplex Slave, DH485

- PCCC Protected Logical Read w/ 2 Address Fields (CMD = 0x0F, FUNC = 0xA1)
- PCCC Protected Logical Write w/ 2 Address Fields (CMD = 0x0F, FUNC = 0xA9)
- PCCC Protected Logical Read w/ 3 Address Fields (CMD = 0x0F, FUNC = 0xA2)
- PCCC Protected Logical Write w/ 3 Address Fields (CMD = 0x0F, FUNC = 0xAA)
- PCCC Protected Logical Write w/ 4 Address Fields (CMD = 0x0F, FUNC = 0xAB)
- PCCC Status Diagnostics (CMD = 0x06, FUNC = 0x03)

Optional EtherNet/IP

- CIP Generic Assembly Object (Class 04), Get & Set Attribute Single for Attribute 3 (data)
- CIP Generic Assembly Object (Class 04), Get Attribute Single for Attribute 4 (size)
- PCCC PLC5 Word Range Write Function (CMD = 0x0F, FUNC = 0x00)
- PCCC PLC5 Word Range Read Function (CMD = 0x0F, FUNC = 0x01)
- PCCC PLC5 Typed Write Function (CMD = 0x0F, FUNC = 0x67)
- PCCC PLC5 Typed Read Function (CMD = 0x0F, FUNC = 0x68)
- PCCC Protected Logical Read Function w/2 Address Fields (CMD = 0x0F, FUNC = 0xA1)
- PCCC Protected Logical Write Function w/2 Address Fields (CMD = 0x0F, FUNC = 0xA9)
- PCCC Protected Logical Read Function w/3 Address Fields (CMD = 0x0F, FUNC = 0xA2)
- PCCC Protected Logical Write Function w/3 Address Fields (CMD = 0x0F, FUNC = 0xAA)
- PCCC Status Diagnostics (CMD = 0x06, FUNC = 0x03)

Modbus RTU Serial and Optional Modbus/TCP Ethernet

The power monitor does not initiate Modbus commands but responds to commands sent by the Modbus master. These Modbus function codes are supported.

- 03 Read Holding Registers
- 04 Read Input Registers
- 16 Write Multiple Holding Registers
- 08 Diagnostics
  - 00 Echo Command Data
  - 02 Return Diagnostic Counters
  - 10 Clear Diagnostic Counters
- 06 Write Single Holding Register

Explicit Messaging

This section discusses data retrieval and parameter configuration using explicit messaging from Rockwell Automation controllers. Explicit messaging allows you to read and write from a controller to specific data tables within the power monitor. With explicit messages, users can read real-time power and energy values, configure analog input parameters, configure communication parameters, and also read energy logs.

In general, these instructions apply to Ethernet network communication (EtherNet/IP protocol) and Serial communication (DF1 half-duplex or full-duplex or DH485 protocols), provided that the protocol is supported by the controller. If using serial communication, the controller serial port must be correctly configured for protocol, communication rate, or parity. Refer to the appropriate controller user documentation for further details.

Please refer to Appendix A, PowerMonitor 1000 Data Tables for descriptions of the power monitor data tables and their data access privileges, and data types.

The power monitor supports PLC-5 Typed, SLC Typed, and CIP Generic message requests.

Explicit Message Setup – Examples

This section gives examples on how to set up explicit messaging.

Read/Write Single or Multiple Elements

You can perform single or multiple element reads and writes to the power monitor. Below is a table documenting the message type to use for specific read write type and communication scenarios. These examples describe message setup for reading data from the power monitor. Refer to Unit Setup by Using Explicit Messaging on page 91, for additional requirements for writing configuration data.

Table 4 - Message Type

Read/Write Type	Communication	Read/Write Message Type
Single Element	Serial	SLC Typed
Single Element	Ethernet	PLC5 Typed or SLC Typed
Multiple Element	Serial	SLC Typed
Multiple Element	Ethernet	PLC5 Typed, SLC Typed Read, or CIP Generic(1)

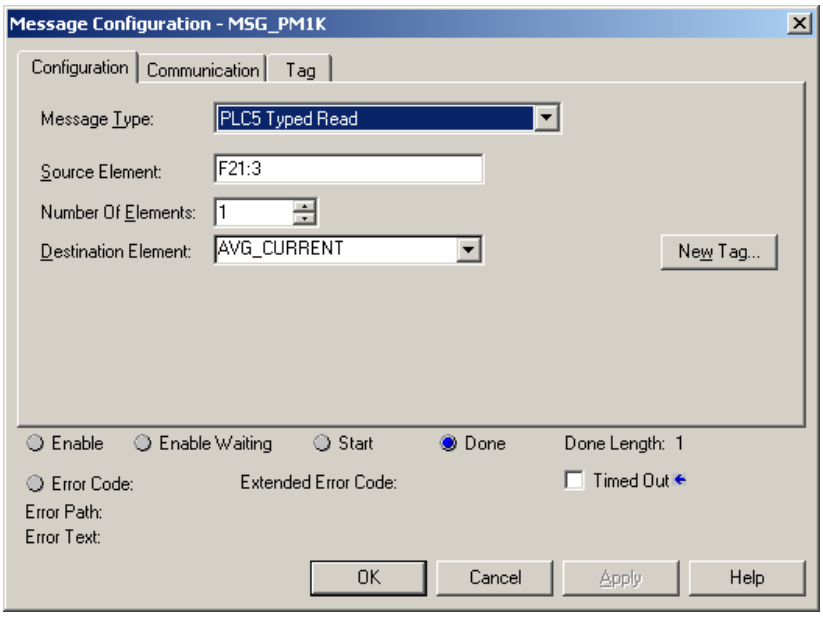
(1) The CIP Generic message type is only available for the Studio 5000 Logix Designer application. All elements in the data table are written to or read back.

Studio 5000 Logix Designer – Message Setup by Using PLC-5 or SLC Typed Read/Write

This is an example of how to set up a message instruction to read or write single or multiple elements from a power monitor using PLC5 or SLC Typed messages. This setup applies to ControlLogix and CompactLogix programmable logic controllers.

Follow these steps to configure a message.

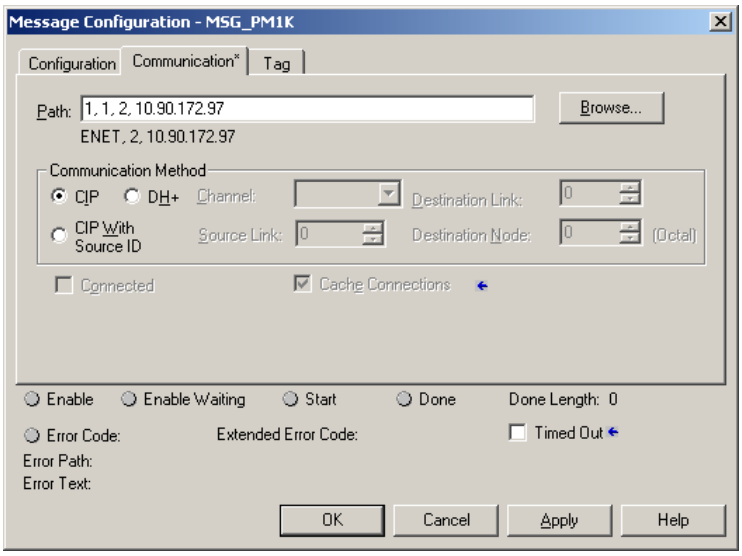
1. Choose the appropriate parameters in the Message Configuration window.



Parameter	Choice
Message type	Select the appropriate message type according to Message Type on page 82.
Source Element	Read: Refer to Appendix A – PowerMonitor 1000 Data Tables for the address of the specific data table address you're reading. If you are performing a multiple element read, this is the first element in the array of elements you're reading back.
	Write: This is the controller tag in which to store the data being written to the power monitor.
Number of Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value must be 1. If you are performing a multiple element read or write, then this value is the number of elements after the source element that you wish to read or write.
Destination Element	Read: This is the controller tag in which to store the data being read.
	Write: Refer to Appendix A – PowerMonitor 1000 Data Tables for the address of the specific data table address you're writing to.

2. Click the Communication tab to select the communication type, either Ethernet or Serial.

3. Choose the communication type and then set the path and communication method.



Communication Type	Path	Method
Ethernet	<Backplane (always 1), Slot of Ethernet Module, Port (always 2 for Ethernet), power monitor IP Address>	CIP
Serial communication	<Port, Power Monitor Serial Node Address>	CIP

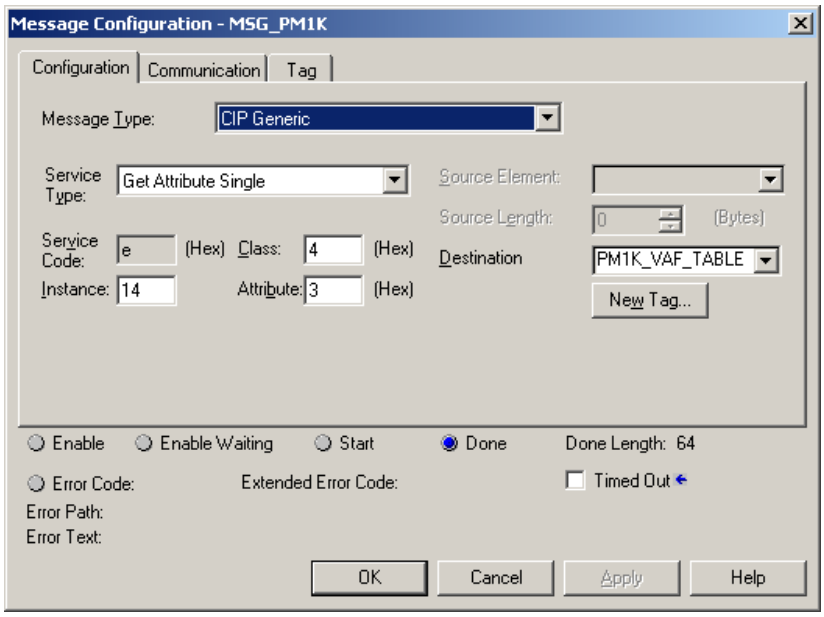
4. Click OK to complete the message setup.

Studio 5000 Logix Designer Application – Message Setup by Using CIP Generic

The following example shows how to set up your message instruction to read or write to a data table in the power monitor by using a CIP Generic message type. This setup applies to ControlLogix and CompactLogix programmable logic controllers. The CIP Generic message type does not support single element reads or writes. In this example, we are reading the Voltage, Amps, and Frequency data table from the power monitor.

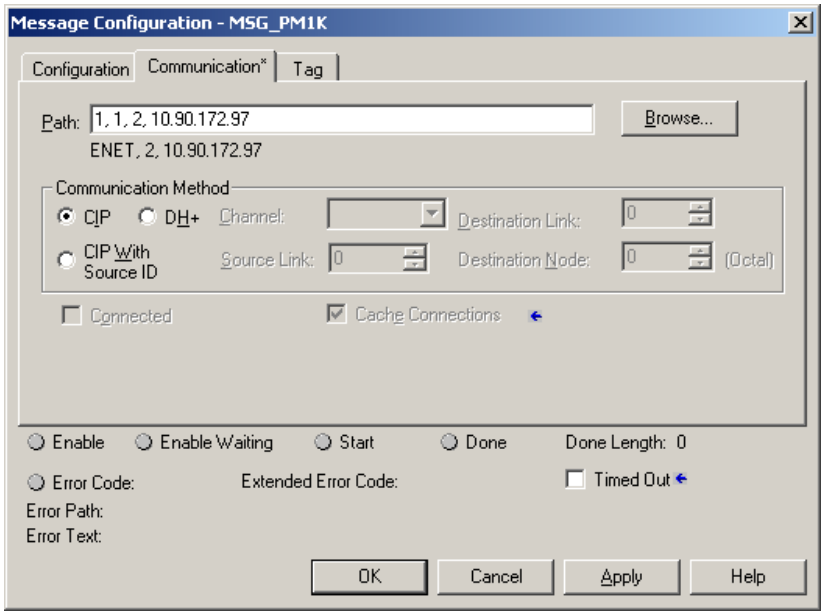
Follow these steps to configure a message.

1. Choose the appropriate parameters in the Message Configuration window.



Parameter	Choice
Message Type	Choose message type CIP Generic.
Service Type	Read**:** Select service type Get Attribute Single
	Write**:** Select service type Set Attribute Single
Instance	Refer to Appendix A for the CIP Instance of the data table you are requesting to read. In this example, the power monitor's Voltage, Amp, and Frequency data table is instance 14.
Class	4
Attribute	3
Destination	Get Attribute Single - This is the controller tag in which to store the data being read.
Source Element	Set Attribute Single - Refer to Appendix A for the address of the specific data table address you're writing to.
Source Length	Set Attribute Single - This is the number of elements of the source element, to be written to the power monitor.

2. Click the Communication tab and enter the path and method.



Path	Method
<Backplane (always 1), Slot of Ethernet Module, Port (always 2 for Ethernet), Power Monitor IP Address>	CIP

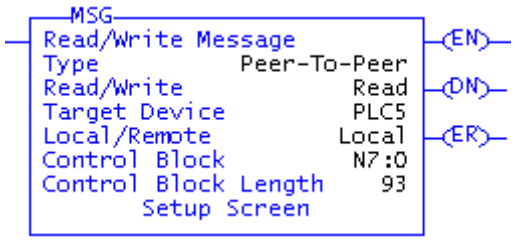
3. Click OK to complete message setup.

RSLogix500 Software - Message Setup by Using PLC-5 or SLC Typed Read/Write

The following is an example of how to set up your message instruction to read or write single or multiple elements to a power monitor using Peer-To-Peer PLC-5 or CPU 500 Typed messages in RSLogix™500 software. This setup applies to SLC and MicroLogix programmable logic controllers.

Follow these steps to configure a message.

1. Set your MSG instruction.



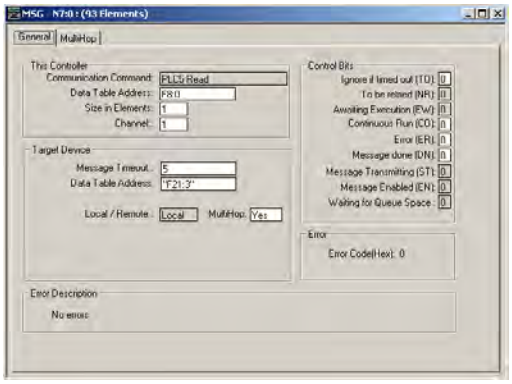
Parameter	Choice
Read/Write	Select Read or Write
Target Device	Select the appropriate message type according to Message Type on page 82.
Local/Remote	Select Local
Control Block	Select an available Integer word. In this example, we used N7:0.

2. Click Setup Screen at the bottom of the message instruction.

   The message configuration window for either Ethernet network or Serial communication appears.

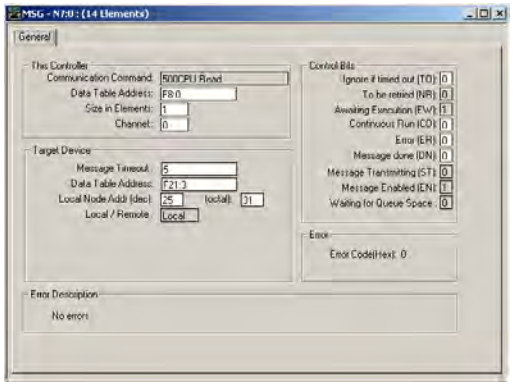
3. Choose the appropriate parameters in the Message Configuration window.

Ethernet Network Communication



Communication Type	Parameter	Choice
Ethernet	Data Table Address (This Controller)	Read: This is the controller tag in which to store the data being read
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value is 1. If you are performing a multiple element read or write, then this value is the number of elements after the source element that you wish to read or write.
	Channel	1
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	MultiHop	Yes

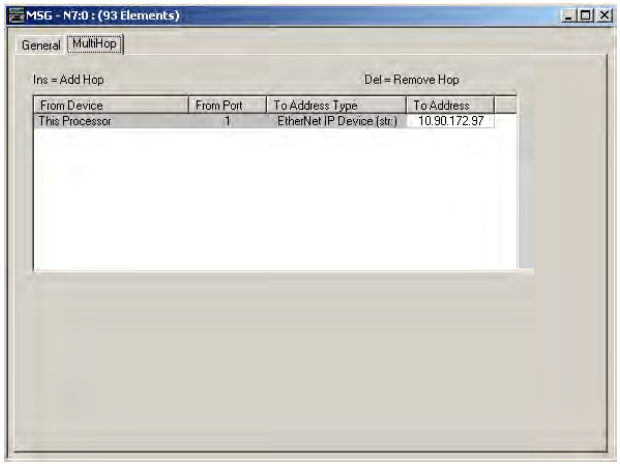
Serial Communication



Communication Type	Parameter	Choice
Serial	Data Table Address (This Controller)	Read: This is the controller tag in which to store the data being read
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value is 1. If you are performing a multiple element read or write, then this value is the number of elements after the source element that you wish to read or write.
	Channel	0
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	Local Node	This is the serial node address of your power monitor.

Message setup is complete for Serial communication.

4. Click the MultiHop tab if configuring Ethernet communication.
5. Enter the IP Address of the power monitor in the To Address box.



Message setup is complete.

RSLogix5 Software - Message Setup Using PLC-5 or SLC Typed Read/Write

The following is an example of how to set up your message instruction to read or write single or multiple elements to a power monitor using PLC-5 or SLC Typed messages in RSLogix5. This setup applies to PLC-5 programmable logic controllers.

Follow these steps to configure a message.

1. Choose an available message data block in your message instruction.

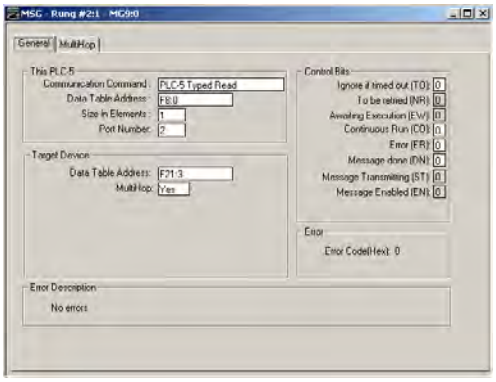
   In this example, we used MG9:0.

2. Click Setup Screen at the bottom of the message instruction.

   The message configuration window for either Ethernet network or Serial communcation appears.

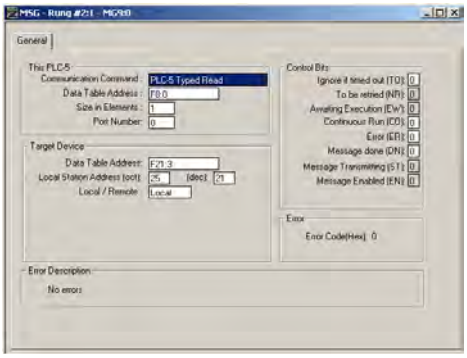
3. Choose the appropriate parameters in the Message Configuration window.

Ethernet Network Communication



Communication Type	Parameter	Choice
Ethernet	Communication Command	Select the appropriate message type according to Message Type on page 82.
	Data Table Address (This Controller)	Read: This is the controller tag in which to store the data being read.
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value is 1. If you are performing a multiple element read or write, then this value is the number of elements after the source element that you wish to read or write.
	Port Number	2
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	MultiHop	Yes

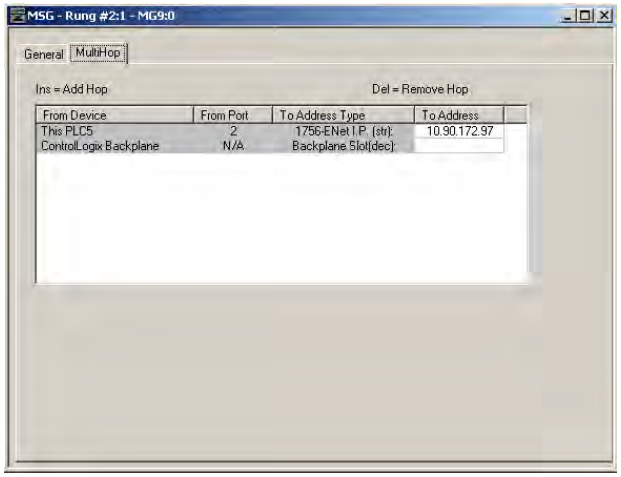
Serial Communication



Communication Type	Parameter	Choice
Serial	Communication Command	Select the appropriate message type according to Message Type on page 82.
	Data Table Address	Read: This is the controller tag in which to store the data being read.
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value is 1. If you are performing a multiple element read or write, then this value is the number of elements after the source element that you wish to read or write.
	Port Number	0
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	Local Station Address	This is the serial node address of your power monitor.
	Local / Remote	Local

Message setup is complete for Serial communication.

4. Click the MultiHop tab if configuring Ethernet communication.
5. Enter the IP Address of the power monitor in the first row of the To Address column.



Message setup is complete.

Unit Setup by Using Explicit Messaging

You can create and edit the setup of a PowerMonitor 1000 unit by writing configuration data by using Explicit Messaging in a programmable controller. These examples are based on the Logix programmable controller family, however can be adapted to any of the message types that are described in the previous section.

The procedures to use for explicit writes change depending on whether CIP explicit message security is enabled or not.

- If it is enabled, then an application must write its Application user name and password for the configuration write to be accepted by the unit.
- If it is not enabled, then the correct Table Password must be employed.

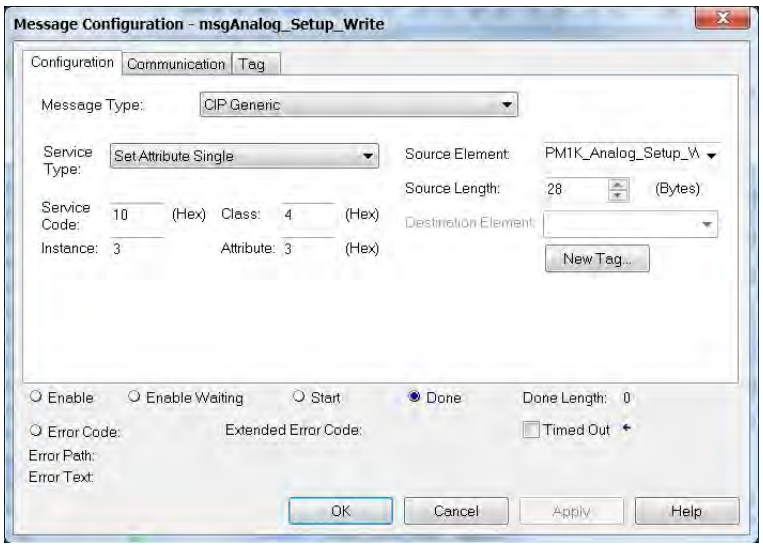
In either case, an explicit message that is written without proper privileges appears to succeed (the DN bit asserts). However, the write is not accepted by the power monitor. The Write Error Status Table indicates the success or failure, and reason for a failure, of the most recent write operation. Applications that manage the power monitor configuration must always read the write error status table to assure correct operation.

Unit Setup Example - Table Password Active

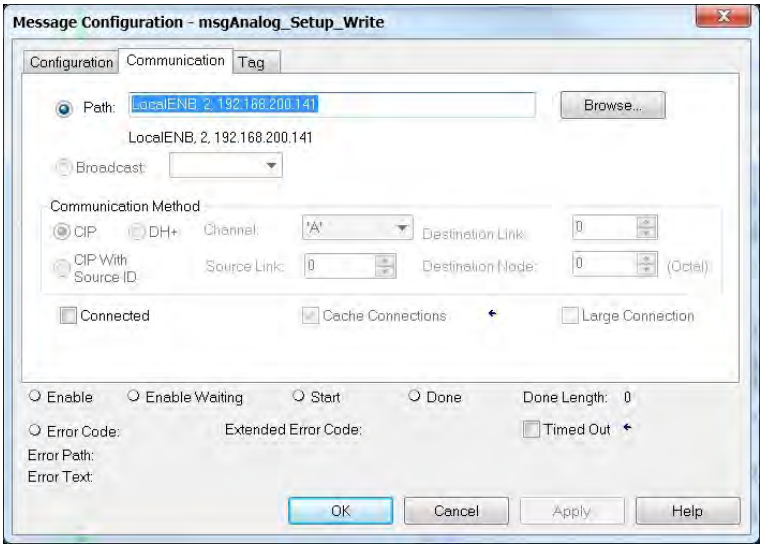
The following example shows how to configure logic to write configuration to a data table in the power monitor and read the status of the write operation, by using CIP Generic message types. This example applies to Logix family programmable controllers and the Logix Designer application. This example writes the Analog Input Setup table by using a Table Password of 0 (the default).

In this simplified rung, the Write Analog Setup bit triggers a message instruction.

The message setup dialog box is the following:



The Communication tab is the following:

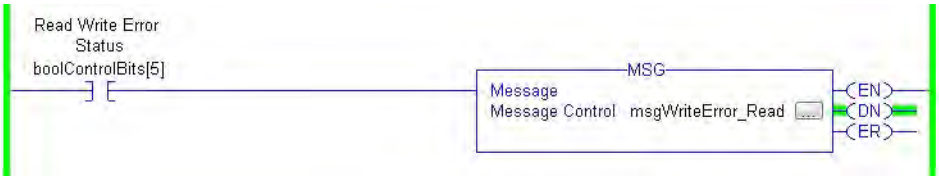


The source data tag is a REAL array of 7 elements:

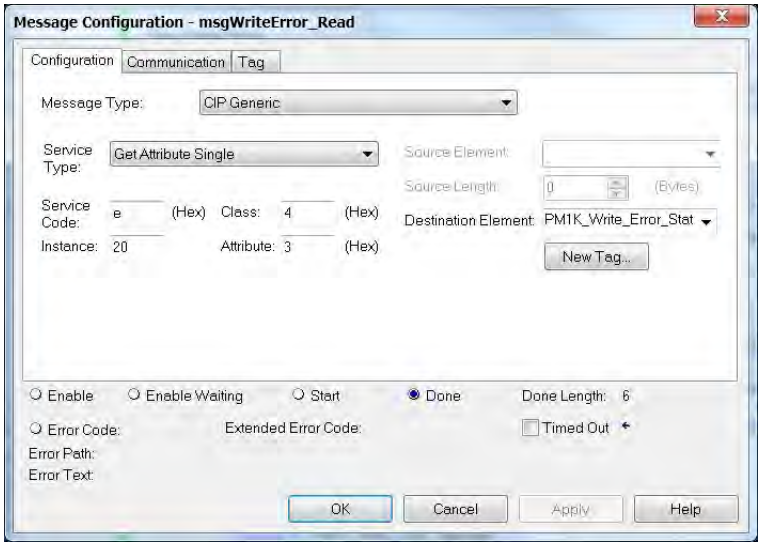
PM1K_Analog_Setup_Write	{...}	{...	Float	REAL[7]
PM1K_Analog_Setup_Write[0]	0.0		Float	REAL
PM1K_Analog_Setup_Write[1]	2.0		Float	REAL
PM1K_Analog_Setup_Write[2]	4160.0		Float	REAL
PM1K_Analog_Setup_Write[3]	120.0		Float	REAL
PM1K_Analog_Setup_Write[4]	1000.0		Float	REAL
PM1K_Analog_Setup_Write[5]	2.0		Float	REAL
PM1K_Analog_Setup_Write[6]	0.0		Float	REAL

The write sets up the power monitor for a Wye system, with a 4160:120 PT ratio, 1000:5 CT ratio, and a low range on system power factor. Note that Element 0 (Table Password) value is 0.

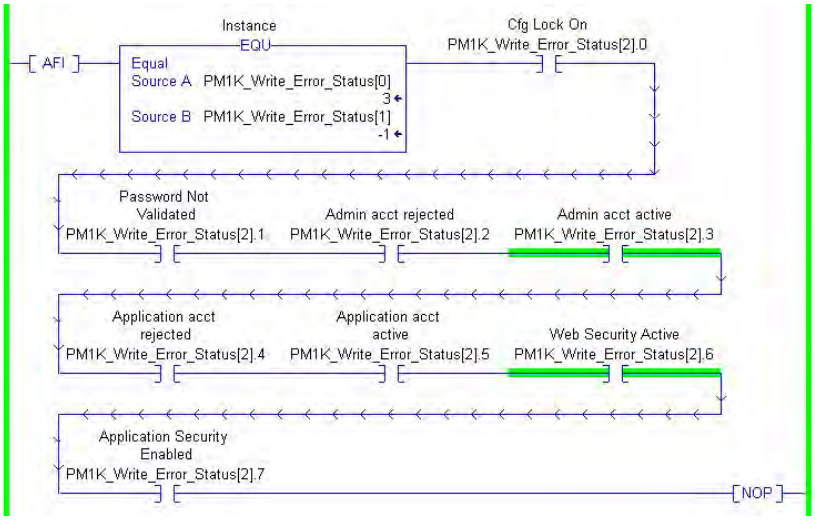
The following rung reads the Write Error Status table:



The message setup dialog box is the following:



This status rung displays the content of the Write Error Status table. The value of element 0 is the instance number last written, and the element 1 value of -1 indicates success. The table also indicates other security information, for instance, web security is enabled and an admin user is logged in. If the table password is not valid, element 0 still indicates instance 3, but element 1 indicates 0 as the offending element (the table password).



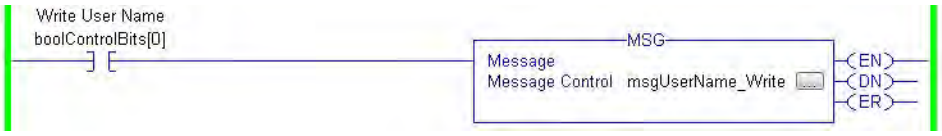
Unit Setup Example - CIP Explicit Message Security Enabled

The following example shows how to use CIP Generic message types to do the following:

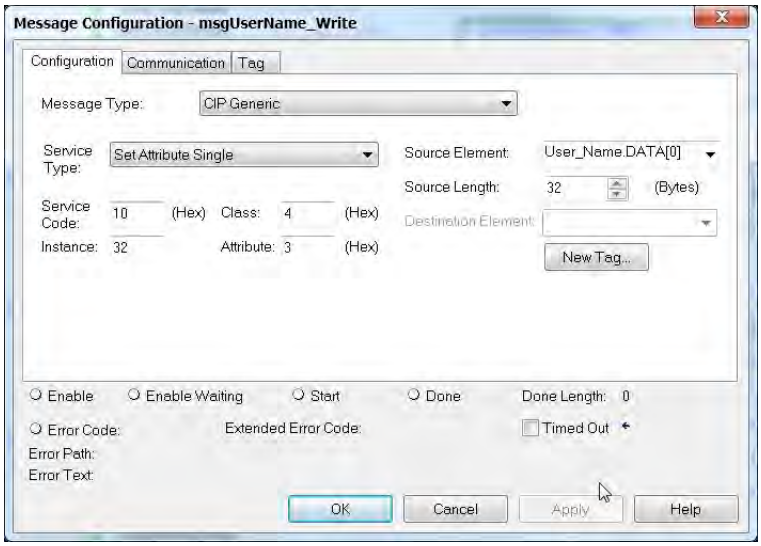
- Set up logic to log in as an Application user
- Write configuration to a data table in the power monitor
- Read the status of the write operation
- Log off

This example applies to Logix family programmable controllers and the Logix Designer application. Like the previous example, this example writes the Analog Input Setup table. In this example, CIP Explicit Message Security is enabled and an Application type user is created with a User Name of 'app' and a Password of 'app'.

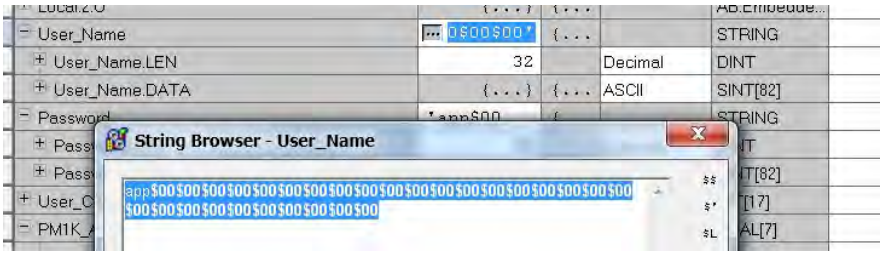
This rung writes the User Name when triggered by the input bit:



The message setup dialog box is the following.

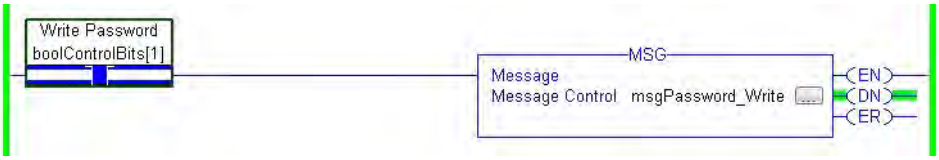


The User Name data table is the following.



The user name is padded with NULL characters so the string length is 32 characters.

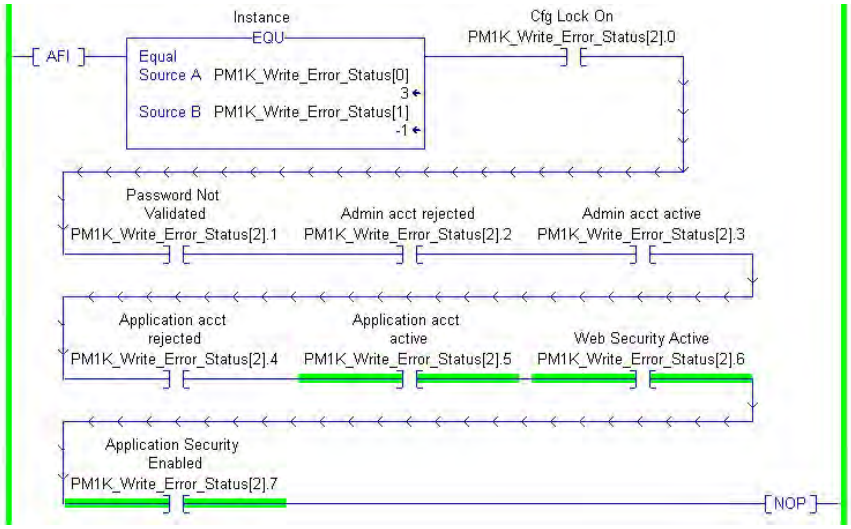
Within 30 seconds, this rung writes the Password to the power monitor.



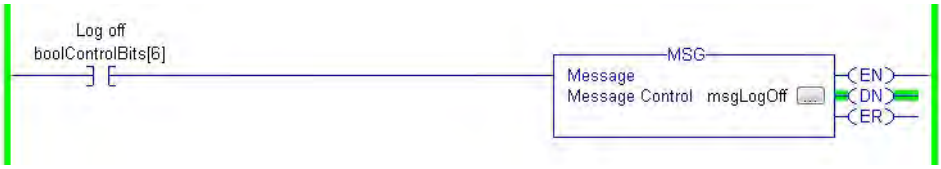
Its message setup dialog box is similar except it writes to Instance 33 from the Password tags, another 32-character STRING tag.

IMPORTANT The MSG instructions to write the user name and password fails if the strings are not 32 characters in length.

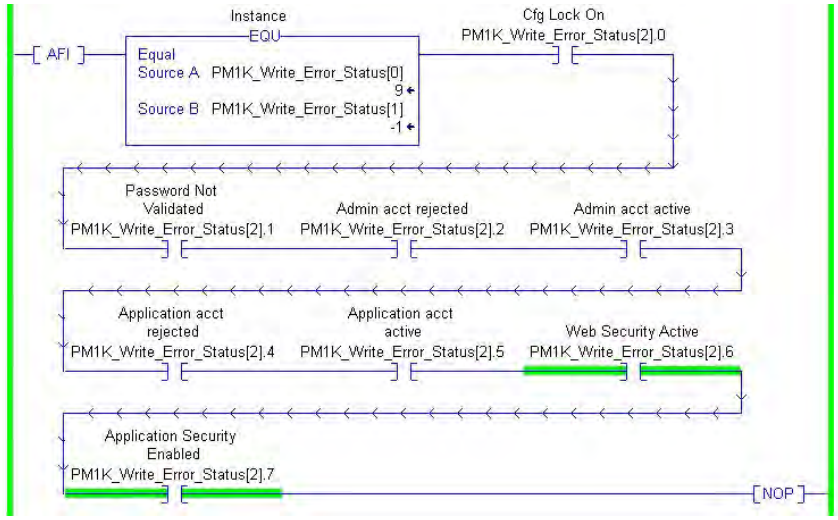
The rungs to write the analog input setup and read the write error status are identical to those in the previous example. The source data tag is also the same, except its element 0 has a value of -1 (it can be any value, since with CIP Explicit Message Security enabled it is ignored). The write error status display rung indicates success and also that application security is active and an application account is active.



After the setup data is written and confirmed, this rung logs the application off of the application account by writing a value of 8 to Instance 9, element 2 and zeroes to the remaining elements of Instance 9.



A read of the Write Error Status table indicates success for the write to Instance 9 and that the application account is now inactive.



Writing Security Credentials - Modbus/TCP

Application security, when enabled, is active on communication between Modbus/TCP clients and the power monitor. The specifics of establishing communication are dependent upon the client used.

The client does not always natively handle STRING data. If the client does not handle STRING data, create Modbus arrays of 16 words that represent the ASCII value of the user name, password, and NULL padding. For example, a user name of 'app1' can be expressed as a 16 = word array {24944, 28721, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, where 24944 and 28721 are the decimal representations of the hexadecimal ASCII codes of 'ap' and 'p1' respectively.

Reading Logs

You can perform explicit messages to read data from log records in the power monitor.

For information on setting up explicit messages to the power monitor, please refer to Explicit Message Setup – Examples on page 82.

The following logs can be read into a controller depending on the logs supported by your power monitor.

- Unit Status Log
- Min/Max Log
- Energy Log
- Load Factor Log (EM3 model only)
- Time of Use Log kWh
- Time of Use Log kVAR
- Time of Use Log kVA
- Internal Error Log
- Alarm Log (EM3 model only)

Please refer to Appendix A for the data table address of the specific log you are requesting.

Log Data Table Methodology

The log data tables only hold one record instance for a specific log. Successive reads of the data table return a successive record instance for that log. By writing to specific configuration elements in the Log Request Table data table, you can configure the log to return in a forward or reverse direction. You can also configure the log to return a specific record for all logs except the Unit Status Log, and Energy Log.

Refer to Log Request Table on page 128 for more information.

Example 1: Read the 5th Log Record in the Load Factor Log

This example explains how to configure the Log Request Table to read the 5th log record in the Load Factor Log.

1. Create a write message to write the following values to the Log Request Table.

Element	Item Name	Value
0	Selected Log	4
1	Chronology of Auto Return Data	0
2	Mix/Max Record to be Returned	0
3	Number of Unit Status Records	0
4	Number of Energy Log Records	0
5	Number of Time of Use Log Records	0
6	Number of Load Factor Log Records	0
7	Load Factor or TOU Record to be Returned	5

2. Create a read message to read the values in the Load Factor Log table.

Example 2: Read Min/Max Log for Average Current

This example explains how to configure the Log Request Table to read the Min/Max log for Average Current.

Refer to Min/Max Parameter List on page 146 for the specific record to return.

In this example, Average Current is record 4.

1. Create a write message to write the following values to the Log Request Table.

Element	Item Name	Value
0	Selected Log	2
1	Chronology of Auto Return Data	0
2	Mix/Max Record to be Returned	4
3	Number of Unit Status Records	0
4	Number of Energy Log Records	0
5	Number of Time of Use Log Records	0
6	Number of Load Factor Log Records	0
7	Load Factor or TOU Record to be Returned	0

2. Create a read message to read the values in the Min/Max Log table.

Calculating Energy Log Depth

How long the Energy Log takes to fill can be as little as 288 hours or as long as three years depending on how you configure the log rate. The Energy records maximum depth is 17280 records that covers the following:

- Status 1 and 2 counters (except BC3)
- Real, Reactive, and Apparent Demand (except BC3)
- Real, Reactive, and Apparent Energy
- Demand Power Factor (except BC3)

Implicit messaging:

- I/O connection
- User configured instance

Implicit Messaging

The 1408-EM3 model provides a user configured data table. You can select the 16 floating-point parameters that comprise this table. Your application can read this table as connected input instance 1, or as CSP file F9 by using explicit messaging.

Setup

You must use serial or Ethernet network communication to set up and read the user configured data table.

To set up the user configured table, using explicit messaging, write a new configuration to the User Configured Table Setup table.

See page 153 for the content, default parameters, and addressing details of the setup table. Pages 154...156 list the available selections for the parameters.

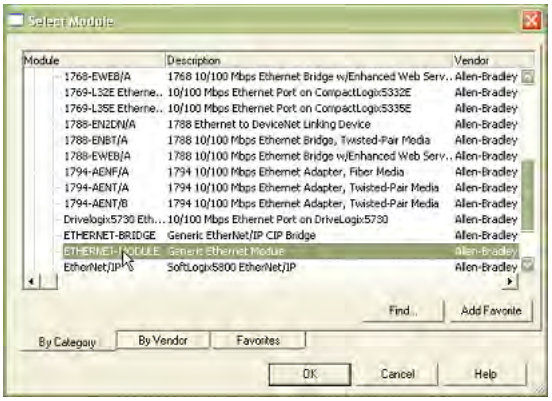
Reading the User Configured Table as Connected Instance 1

The following example illustrates the steps required to set up an I/O connection between a Logix controller and the user configured Instance 1. The example uses a CompactLogix controller and Studio 5000 Logix Designer application.

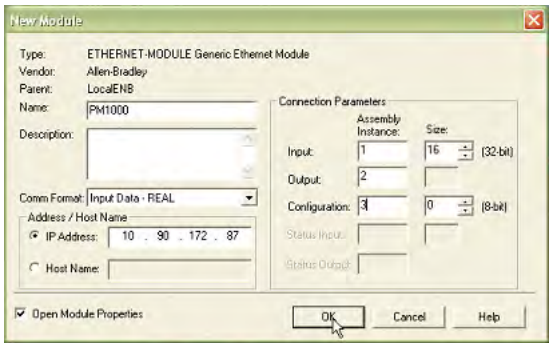
Follow these steps to configure the connection.

1. Open an offline project in the Logix Designer application.
2. Open the Ethernet network interface and select the Ethernet network.

3. Add a new module and choose Generic Ethernet Module from the Communication group.



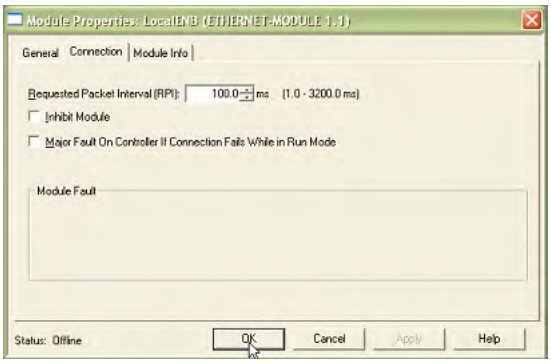
4. Configure the properties of the new module and click OK.



Parameter	Choice
Name	Your choice of name
Comm Format	Input Data - REAL
IP Address	The IP address of your power monitor
Input	Assembly Instance 1; Size 16 (32-bit)
Output	Assembly Instance 2
Configuration	Assembly Instance 3; Size 0
Open Module Properties	Leave checked

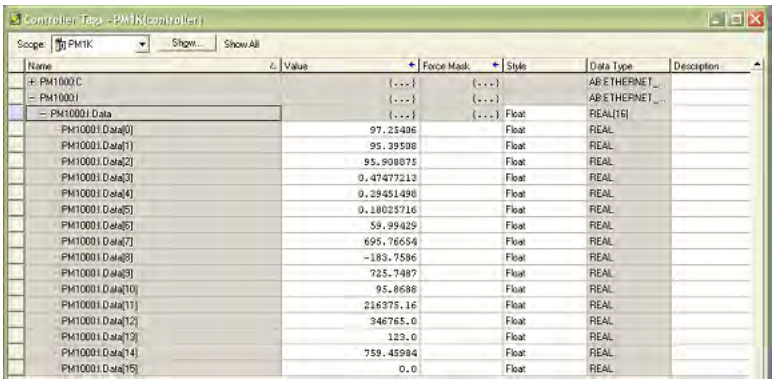
5. On the connection tab, enter the desired Requested Packet Interval (RPI).

   Do not enter an RPI less than 100 mS.



6. Click OK, then Save and download the offline project into the controller.

The data from the user configured table is read into the controller tag [Module Name]:I.Data without any further logic programming, at the selected RPI rate.



IMPORTANT You can create a user-defined data type (UDT) in the Logix Designer application with symbolic tag names that identify the selected parameters, create a tag based on the UDT, and COP or CPS the PM1000:I.Data tag to the new tag, providing more meaningful tag descriptions in your program.

A power monitor connected instance can be owned by only one controller. An error results if you attempt to establish a connection with more than one controller. You can use explicit messaging to read the F9 table from any number of controllers.

SCADA Applications

This section covers RSLinx driver setup, and OPC setup by using the RSLinx OPC Server.

RSLinx Classic Drivers Configuration

Install the PowerMonitor 1000 unit EDS file on the computer running RSLinx Classic software before configuring drivers. RSLinx software supports DF1 half-duplex, DF1 full-duplex, and EtherNet/IP network communication.

Configure DF1 Half-duplex

Refer to RS-485 Multi-drop Typical Wiring on page 33 for information on the physical network connections. Verify the DF1 Address of the power monitor, and that its Protocol Setting is DF-1 Half Duplex Slave or Auto Sense.

1. Create a DF1 Polling Master Driver in RSLinx software.
2. Verify that the communication rate in the Port Configuration tab is the same as the communication rate set for your power monitor.

3. Set the Error Checking Mode in the DF1 Protocol Settings tab to CRC.
4. Set the Destination Station Out-of-List Strategy in the Polling Strategies tab to Allow Msgs to Stns that are not in lists.
5. Add the DF1 address of your power monitor to the Normal polling list in the Define Polling Lists tab.
6. Click OK when done.
7. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

Configure DF1 Full-duplex

Refer to RS-485 Point-to-point Typical Wiring on page 33 for information on the physical network connections.

1. Create a RS232 DF1 devices driver in RSLinx Classic software.
2. Perform an Auto-configure.
3. Verify connections if Auto-configure fails.
4. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

Configure RSLinx Software Driver Configuration for DH485

Refer to RS-485 Multi-drop Typical Wiring on page 33 for information on the physical network connections.

1. Open the RSLinx Classic Launch Control Panel.
2. Start RSLinx software to run as normal application, not as service.
3. Create a 1747-PIC/AIC+ Driver in RSLinx software.
4. Verify that the communication rate is the same as the communication rate set for your power monitor.
5. Set the node address and maximum node address of RSLinx Driver.
6. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.
7. Restart RSLinx software to run as service.

Configure EtherNet/IP Network by Using Ethernet Devices Driver

1. Create an Ethernet devices driver in RSLinx Classic software.
2. Add the IP address of the power monitor to the driver station mapping.
3. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

Configure EtherNet/IP Network by Using EtherNet/IP Driver

1. Create an EtherNet/IP driver in RSLinx Classic software.
2. Make selections to browse the local or remote subnet as appropriate.
3. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

IMPORTANT The power monitor makes a connection to either the RSLinx Ethernet Devices driver or the EtherNet/IP driver on a single computer but not both simultaneously.

RSLinx Classic Software OPC Server Setup

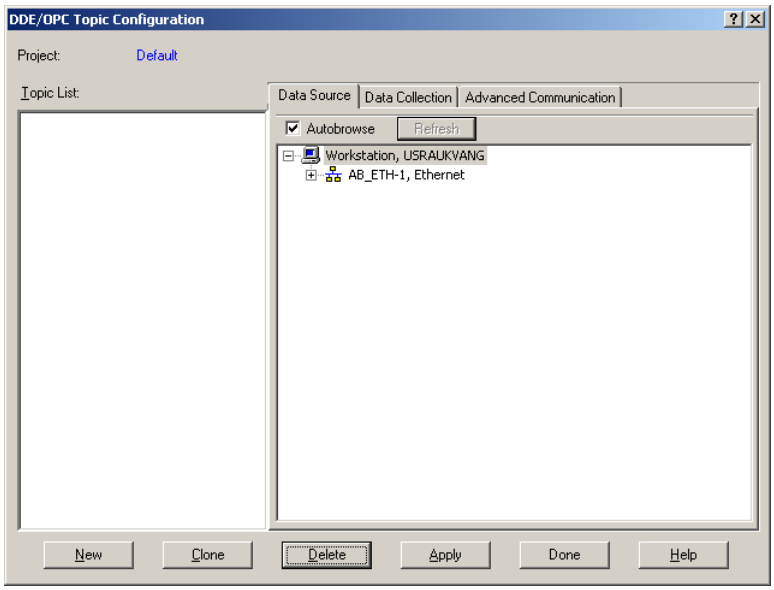
You can set up RSLinx Classic software as an OPC Server to serve data from a power monitor to an OPC 2.0 compliant application. You must first set up an RSLinx driver to communicate to the power monitor. You can then create an OPC topic to serve data to your SCADA application.

Set Up OPC Topic

Follow these steps to set up a DDE/OPC topic in RSLinx software for the power monitor.

1. Open RSLinx software.
2. From the DDE/OPC menu, choose Topic Configuration.

   This configuration window appears.



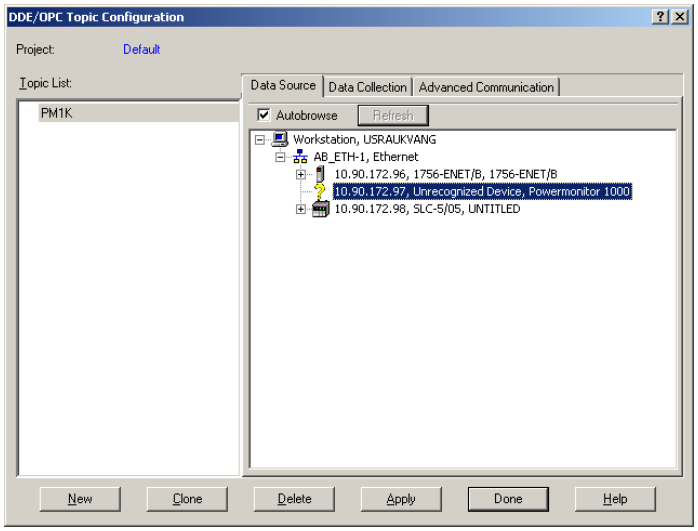
3. Click New.

   This creates a topic in the Topic List.
4. Name the topic pertinent to your application.

5. In the right pane, under the Data Source tab, browse to your power monitor.

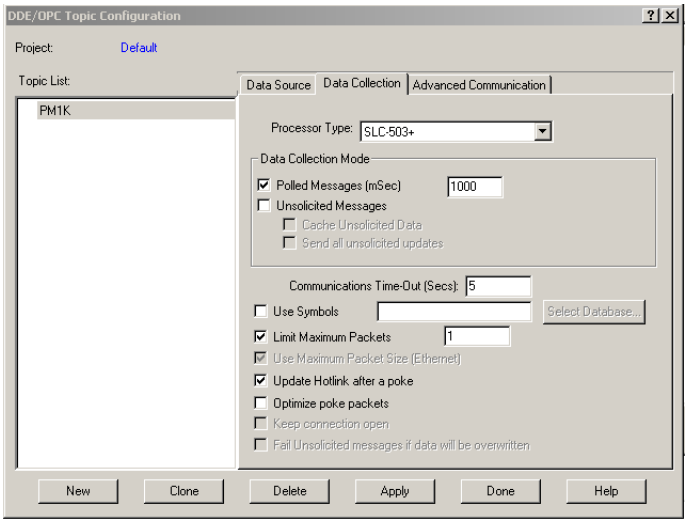
   You can use a serial or Ethernet network driver.

   TIP When using a DH485 driver, change the connection type to local addressing mode in the Advanced Communication tab. Local addressing mode is especially important when several topics use the DH485 driver.



6. Make sure that the topic is highlighted in the left pane, and that the power monitor is also highlighted in the right pane, then click Apply.
7. Click the Data Collection tab.

8. From the Processor Type menu, choose SLC 503+.



9. Click Done.

   OPC Topic configuration is complete.

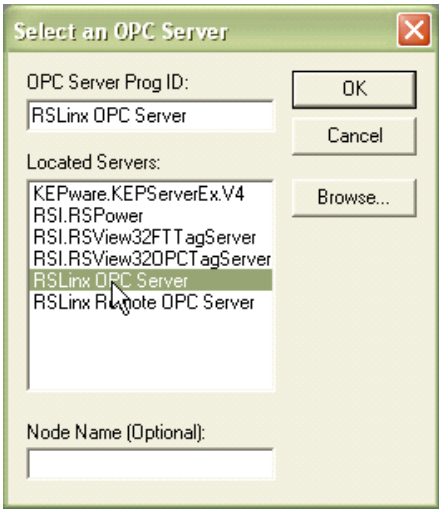
You can now use the RSLinx OPC Server, and the topic just created, to serve data to your application.

OPC item addresses are of the format [OPC Topic Name]Address,Ln,C1 where Address is the power monitor data address (example: F21:7). Optional argument Ln is the length of the array requested in elements. If the Ln argument is used, C1 (number of array columns) must also be specified.

Browse OPC Tags

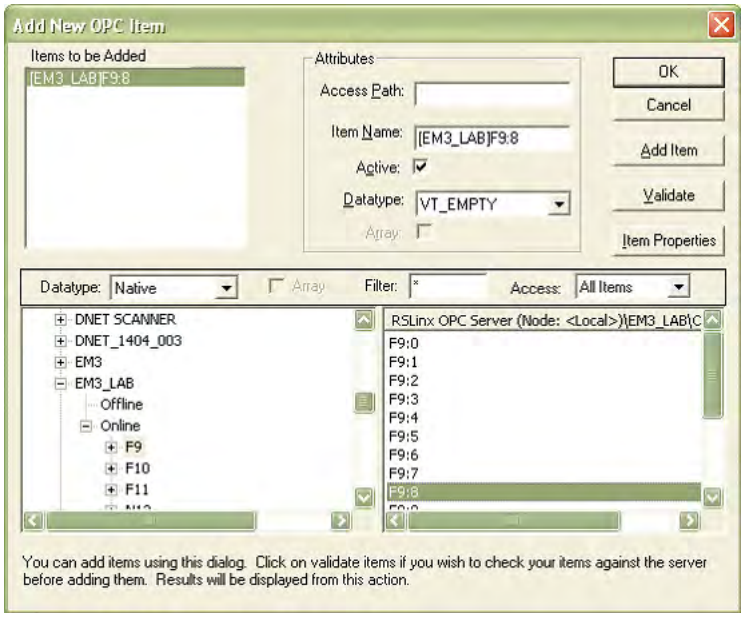
The power monitor supports OPC tag browsing. The example uses the RSI OPC Test Client to illustrate tag browsing.

1. Open the RSI Test Client and connect to the RSLinx Classic OPC Server.



2. Add a group, then add an item. Browse to the OPC topic and then to the table and element in the Online tags.

   In this example, the User Configured Read Instance F9, element 8, in the OPC topic EM3_LAB is selected.



3. Click OK and start viewing data.

Notes:

PowerMonitor 1000 Data Tables

Summary of Data Tables

The Summary of PowerMonitor 1000 Data Tables for all Communication Protocols table summarizes all data tables available and their general attributes

Table 5 - Summary of PowerMonitor 1000 Data Tables for all Communication Protocols

Name of Data Table	Data Access	CSP File No.	CIP Ass'y Inst.	Modbus Addressing Range	No of Elements	BC3	TS3	EM3	Refer to Page
User Configured Table Results	R	F9	1	31601…31632	16		•	•	111
Analog Input Configuration	RW	F10	3	40001…40014	7	•	•	•	112
Advanced Configuration	RW	F11	4	40101…40144	22	•	•	•	113
RS485 Configuration	RW	N12	5	40201…40209	9	•	•	•	116
Ethernet Configuration	RW	N13	6	40301…40323	23	•	•	•	117
Time Zone Information									119
Date and Time Configuration	RW	N14	7	40401…40408	8	•	•	•	121
Log Configuration	RW	N15	8	40501…40512	12	•	•	•	122
Command	W	F16	9	40601…40644	22	•	•	•	125
Log Request	RW	N17	10	40701…40711	11	•	•	•	128
Controller Interface	W	N18	11	40801…40808	8			•	130
Discrete Results	R	N19	12	30001…30006	6	•	•	•	131
Wiring Diagnostics Results	R	F20	13	30101…30142	21	•	•	•	132
Volts Amps and Frequency Results	R	F21	14	30201…30232	16		•	•	134
Power Results	R	F22	15	30301…30334	17	•	•	•	135
Energy Results	R	F23	16	30401…30438	19	•	•	•	136
Demand Results	R	F24	17	30501…30518	9			•	137
Unit Status Log Results	R	N25	18	30601…30613	13	•	•	•	138
Unit Status Log Code									139
Energy Log Results	R	F26	19	30701…30742	21	•	•	•	141
Write Error Status Results	R	N27	20	30801…30803	3	•	•	•	142
Unit Run Status Results	R	N28	21	30901…30925	25	•	•	•	143
Min/Max Log Results	R	F29	22	31001…31022	11	•	•	•	145
Min/Max Parameter List						•	•	•	146
Load Factor Log Results	R	F30	23	31101…31128	14			•	147
Time of Use Log Results- Real Energy and Demand	R	F31	24	31201…31224	12	•	•	•	148
Time of Use Log Results - Reactive Energy and Demand	R	F32	25	31301…31324	12	•	•	•	149

Table 5 - Summary of PowerMonitor 1000 Data Tables for all Communication Protocols

Name of Data Table	Data Access	CSP File No.	CIP Ass'y Inst.	Modbus Addressing Range	No of Elements	BC3	TS3	EM3	Refer to Page
Time of Use Log Results - Apparent Energy and Demand	R	F33	26	31401…31424	12	•	•	•	150
Catalog Number and WIN	R	N34	27	31501…31519	19	•	•	•	151
Single Element Password Write	W	N35	28	40901	1	•	•	•	152
User Configurable Table Setup	R/W	N44	29	41001…41017	17		•	•	153
Parameters for Configurable Table							•	•	154
Security Policy Configuration	R/W	N45	30	41101…41115	15	•	•	•	157
Security Policy Status	R	N46	31	31901…31901	1	•	•	•	159
Security UserName	W	ST47	32	41201…41216	1	•	•	•	160
Security Password	W	ST48	33	41301…41316	1	•	•	•	161
Alarm Status Results	R	N49	34	31701…31709	9			•	162
Alarm Log Results	R	N50	35	31801…31808	8			•	163
Alarm Log Code								•	164
DF1 PCCC Diagnostic Status Reply						•	•	•	165
Parameter Object Instances						•	•	•	166

Data Tables

These tables detail each specific data table and its associated elements, such as Modbus address, default value, ranges, and description.

IMPORTANT The lock symbol designates that the parameter that is marked is not be able to be written when the hardware lock terminals are connected together.

User Configurable Table Results

Table 6 - Table Properties

CSP File No.	F9
CIP Instance	1
Applies to	EM3, TS3 only
No. of Elements	16
No. of Words	32
Data Type	Float
Data Access	Read Only

Table 7 - User Configurable Table Results

Element No.	Modbus Address	Element Name	Description
0	31601-2	User selected Parameter #1	Parameters previously setup during a write to User Configurable Table Setup table.
1	31603-4	User selected Parameter #2	
2	31605-6	User selected Parameter #3	
3	31607-8	User selected Parameter #4	
4	31609-10	User selected Parameter #5	
5	31611-12	User selected Parameter #6	
6	31613-14	User selected Parameter #7	
7	31615-16	User selected Parameter #8	
8	31617-18	User selected Parameter #9	
9	31619-20	User selected Parameter #10	
10	31621-22	User selected Parameter #11	
11	31623-24	User selected Parameter #12	
12	31625-26	User selected Parameter #13	
13	31627-28	User selected Parameter #14	
14	31629-30	User selected Parameter #15	
15	31631-32	User selected Parameter #16	

Analog Input Configuration

Table 8 - Table Properties

CSP File No.	F10
CIP Instance	3
Applies to	All models
No. of Elements	7
No. of Words	14
Data Type	Float
Data Access	Read/Write

Table 9 - Analog Input Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40001-2	Table Password	0	0…9999	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	40003-4	Voltage Mode	2	0…6	Must match the external electrical system and how it is wired to the power monitor voltage and current input terminals. See page 21 for wiring diagrams. 0 = Direct Delta 1 = Open Delta 2 = Wye 3 = Split Phase 4 = Demo 5 = 1PT-1CT LL 6 = 1PT-1CT LN
2	40005-6	PT Primary	480	1.00… 50,000	The first value of the PT ratio (xxx:xxx) indicating the nominal voltage present at the high-end of the transformer. If no transformer is used (for direct connect of up to 347V L-N or 600V L-L), set the PT ratio to any valid 1:1 ratio (for example 480:480).
3	40007-8	PT Secondary	480	1.00… 600.00	The second value of the PT ratio (xxx:xxx) indicating the nominal voltage present at the low-end of the transformer.
4	40009-10	CT Primary	5	5.00… 50,000	The first value of the CT ratio (xxx:5) indicating the nominal current present at the high-end (primary side) of the transformer. Example: PRI = 1000. Setting = 1000:5. 5 A is the nominal secondary current of the CT.
5	40011-12	System PF Setting	2	0…2	0 = Leading -97…89 1 = High -85…98 2 = Low -52…-95
6	40013-14	Reserved	0	0	Reserved for future use.

Advanced Configuration

Table 10 - Table Properties

CSP File No.	F11
CIP Instance	4
No. of Elements	22
No. of Words	44
Data Type	Float
Data Access	Read/Write

Table 11 - Advanced Configuration

Element No.	Modbus Address Range	Element Name	Default Value	Range	BC3	TS3	EM3	Description
0	40101-2	Table Password	0	0…9999	•	•	•	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	40103-4	New Table Password	0	-1…9999	•	•	•	This becomes the new password when the proper configuration password entry has been made and this parameter is greater than (-1).
2 🔒	40105-6	Metering Result Averaging	1	0…1	•	•	•	The metering results for volts, amps, power and frequency is averaged over 8 cycles of data to provide a steady output reading. 0 = Off 1 = On
3	40107-8	Log Status Input Changes	0	0…1		•	•	0 = Disable recording of status input changes into the status log. 1 = Enable recording of status input changes into the status log.
4	40109-10	Use Daylight Saving Correction	0	0…1	•	•	•	0 = Disable Daylight Saving 1 = Enable Daylight Saving
5	40111-12	Daylight Saving Month/ Week/Day Start	030201 March, 2nd week, Sunday	10101… 120507	•	•	•	This is the day that the power monitor adds an hour to the time. This feature also looks at Ethernet SNTP offset and corrects for Daylight Saving. Example: 040101 = April/1st week/Sunday Month Settings: 01 = January…12 = December Week Settings: 01 = 1st week…05 = Last Week Day of the Week Settings: 01 = Sunday…07 = Saturday
6	40113-14	Hour of Day Start	2	0…23	•	•	•	The hour of day the daylight saving adjustment is made to add an hour.

Table 11 - Advanced Configuration

Element No.	Modbus Address Range	Element Name	Default Value	Range	BC3	TS3	EM3	Description
7	40115-16	Return from Daylight Saving Month/ Week/Day	110101 November, 1st week, Sunday	10101… 120507	•	•	•	This is the day that the power monitor subtracts an hour from the time. This feature also looks at Ethernet SNTP offset and corrects for the return from Daylight Saving. Month Settings: 01 = January…12 = December Week Settings: 01 = 1st week…05 = Last Week Day of the Week Settings: 01 = Sunday…07 = Saturday
8	40117-18	Hour of Day End	2	0…23	•	•	•	The hour of day the daylight saving adjustment is made to subtract an hour.
9 🔒	40119-20	KYZ Solid State Output Parameter	0	0…5		•	•	The parameter selected pulses the KYZ output at a rate that equals the parameter value divided by KYZ scale. 0 = Disable 1 = Wh Fwd 2 = Wh Rev 3 = VARh Fwd 4 = VARh Rev 5 = Vah
10 🔒	40121-22	KYZ Solid State Output Scale	1,000	1… 100,000		•	•	The KYZ output parameter divided by the scale is the output pulse rate. Example: Wh is selected for the parameter and 1,000 is the scale value. The output is pulsed every kWh.
11 🔒	40123-24	KYZ Pulse Duration Setting	250 ms	0 or 50…1000		•	•	Set as 50…1000 to indicate the duration of the pulse in milliseconds, or set to 0 for KYZ-style transition output. (Toggle) The value for delay is rounded off to the nearest 10 ms internally during this function.
12 🔒	40125-26	Status Input 1 Input Scale	1	1… 1,000,000		•	•	When a status pulse is received the count is increased by the scale factor. Input pulse * input scale added to total status count.
13 🔒	40127-28	Status Input 2 Input Scale	1	1… 1,000,000		•	•	When a status pulse is received the count is increased by the scale factor. Input pulse * input scale added to total status count.
14 🔒	40129-30	Demand Source	0	0…3			•	When item Demand Broadcast Master Select of the ethernet table is set to master a selection of 0…2 sets the type of master input. In this case item 3 is ignored. When the Demand Broadcast Master Select of the Ethernet table is set to slave then any of these inputs can set the end of the demand period. Selections of 0…2 can be selected for RS485 units. 0 = Internal Timer 1 = Status Input 2 2 = Controller Command 3 = Ethernet Demand Broadcast Selection 3 can only be programmed when the Ethernet option is installed.
15 🔒	40131-32	Demand Period Length	15 min	0…99			•	Specifies the desired period for demand calculations. When set to 0 there are no projected demand calculations. If the internal timer is selected a setting of 0 turns the demand function off.

Table 11 - Advanced Configuration

Element No.	Modbus Address Range	Element Name	Default Value	Range	BC3	TS3	EM3	Description
16 🔒	40133-34	Number of Demand Periods	1	1…15			•	Specifies the number of demand periods to average for demand measurement.
17 🔒	40135-36	Forced Demand Sync Delay	10 s	0…900 s			•	When the power monitor is configured for external demand control the unit delays for xxx seconds after the expected control pulse has not been received. The demand period starts over and a record is recorded in the status log. 0 = Wait forever 1…900 = Wait this many seconds before starting a new demand period. This setting becomes active when the demand interval is set from 1…99 minutes.
18	40137-38	Unit Error Action	1	0…1	•	•	•	This parameter determines the action when a unit error occurs. 0 = Halt on error and make status LED solid red 1 = Reset power monitor hardware.
19	40139-40	Software Error Log Full Action	1	0…1	•	•	•	This parameter determines the action when a firmware failure is detected and the error log is full. 0 = Halt on error and wait for clear log command, also make status LED solid red 1 = Perform a firmware reset.
20	40141-42	Reserved	0	0	•	•	•	Reserved for future use.
21	40143-44	Reserved	0	0	•	•	•	Reserved for future use.

Serial RS-485 Port Configuration

Table 12 - Table Properties

CSP File No.	N12
CIP Instance	5
Applies to	All models
No. of Elements	9
No. of Words	9
Data Type	Integer
Data Access	Read/Write

Table 13 - Serial RS-485 Port Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40201	Table Password	0	0…9999	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	40202	Protocol Setting	1	0…4	The protocol selection for communication. 0 = DF1 Half Duplex Slave 1 = DF1 Full Duplex 2 = Modbus RTU Slave 3 = Auto Sense 4 = DH485
2	40203	Serial Delay (5ms)	2 (10 ms)	1…15	The setting times 5 = milliseconds that the unit waits before responding to a communication request. Useful for consistent communication and slow devices.
3	40204	Baud Rate	5	0…6	The serial communication baud rate. 0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 38,400 6 = 57,600
4	40205	DF1/Modbus/ DH485 Address	Device ID, 31 for DH485	1…247 (DF1, Modbus) 0…31 (DH485)	During production the Device ID is printed on the nameplate. This ID then becomes the default address for DF1 and Modbus.
5	40206	Data Format	0	0…2 (2 for DH485)	Parity, number of data bits, number of stop bits 0 = No parity, 8 data bits, 1 stop bit 1 = Odd parity, 8 data bits, 1 stop bit 2 = Even parity, 8 data bits, 1 stop bit
6	40207	Intercharacter Timeout (ms)	0	0… 6553	Specifies the minimum delay between characters that indicates the end of a message packet for Modbus protocol. 0 = 3.5 character times in default. The unit is ms.
7	40208	Maximum Node Address	31	1…31	Specifies the maximum node address on a DH485 network.
8	40209	Reserved	0	0	Reserved for future use.

Ethernet Configuration

Table 14 - Table Properties

CSP File No.	N13
CIP Instance	6
No. of Elements	23
No. of Words	23
Data Type	Integer
Data Access	Read/Write

Table 15 - Ethernet Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
0	40301	Table Password	0	0…9999	•	•	•	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	40302	IP Address Byte a (aaa.xxx.xxx.xxx)	192	0…255	•	•	•	The 1st Octet of the Static IP Address.
2	40303	IP Address Byte b (xxx.bbb.xxx.xxx)	168	0…255	•	•	•	The 2nd Octet of the Static IP Address.
3	40304	IP Address Byte c (xxx.xxx.ccc.xxx)	254	0…255	•	•	•	The 3rd Octet of the Static IP Address.
4	40305	IP Address Byte d (xxx.xxx.xxx.ddd)	Unit ID	0…255	•	•	•	The 4th Octet of the Static IP Address.
5	40306	Subnet Mask Byte a	255	0…255	•	•	•	Specifies the subnet mask to apply to the IP address.
6	40307	Subnet Mask Byte b	255	0…255	•	•	•	Specifies the subnet mask to apply to the IP address.
7	40308	Subnet Mask Byte c	0	0…255	•	•	•	Specifies the subnet mask to apply to the IP address.
8	40309	Subnet Mask Byte d	0	0…255	•	•	•	Specifies the subnet mask to apply to the IP address.
9	40310	Gateway IP Address Byte a	128	0…255	•	•	•	IP address of the gateway to other subnets for wide area networking.
10	40311	Gateway IP Address Byte b	1	0…255	•	•	•	IP address of the gateway to other subnets for wide area networking.
11	40312	Gateway IP Address Byte c	1	0…255	•	•	•	IP address of the gateway to other subnets for wide area networking.
12	40313	Gateway IP Address Byte d	1	0…255	•	•	•	IP address of the gateway to other subnets for wide area networking.
13	40314	SNTP Mode Select	0	0…2	•	•	•	This mode selects the mode of the SNTP function or to disable the SNTP function. 0 = Disable 1 = Unicast - The SNTP address points to a unicast server. 2 = Anycast Mode - The SNTP address is a broadcast address of an anycast group.

Table 15 - Ethernet Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
14	40315	SNTP Update Interval	300	1…32766	•	•	•	Indicates how often the time is updated from the SNTP Server. The unit is minute.
15	40316	Time Zone Select	7	0…32	•	•	•	The time zone table has detailed time zone information.
16	40317	Time Server IP Address Byte a	0	0…255	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
17	40318	Time Server IP Address Byte b	0	0…255	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
18	40319	Time Server IP Address Byte c	0	0…255	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
19	40320	Time Server IP Address Byte d	0	0…255	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
20	40321	Demand Broadcast Master Select	0	0…1			•	When configured as a Master the power monitor broadcasts an end of demand interval broadcast to the UDP port number configured. 0 = Slave 1 = Master control
21	40322	Broadcast Port Number	300	300…400			•	When configured as a Master and External Demand Source or Ethernet Demand Broadcast the port number is the listening or broadcast port for the UDP message.
22	40323	IP Address Obtain	0	0…1	•	•	•	0 = Static IP 1 = DHCP

Table 16 - Time Zone Information

Value	Offset from GMT	Time Zone Name	Areas in Time Zone
0	GMT-12:00	Dateline Standard Time	Eniwetok, Kwajalein
1	GMT-11:00	Samoa Standard Time	Midway Island, Samoa
2	GMT-10:00	Hawaiian Standard Time	Hawaii
3	GMT-09:00	Alaskan Standard Time	Alaska
4	GMT-08:00	Pacific Standard Time	Pacific Time (US & Canada,; Tijuana)
5	GMT-07:00	Mountain Standard Time	Mountain Time (US & Canada)
		US Mountain Standard Time	Arizona
6	GMT-06:00	Canada Central Standard Time	Saskatchewan
		Central America Standard Time	Central America
		Central Standard Time	Central Time (US & Canada)
		Mexico Standard Time	Mexico City
7	GMT-05:00	Eastern Standard Time	Eastern Time (US & Canada)
		SA Pacific Standard Time	Bogota, Lima, Quito
		US Eastern Standard Time	Indiana (East)
8	GMT-04:00	Atlantic Standard Time	Atlantic Time (Canada)
		Pacific SA Standard Time	Santiago
		SA Western Standard Time	Caracas, La Paz
9	GMT-03:30	Newfoundland Standard Time	Newfoundland
10	GMT-03:00	E. South America Standard Time	Brasilia
		Greenland Standard Time	Greenland
		SA Eastern Standard Time	Buenos Aires, Georgetown
11	GMT-02:00	Mid-Atlantic Standard Time	Mid-Atlantic
12	GMT-01:00	Azores Standard Time	Azores
		Cape Verde Standard Time	Cape Verde Is.
13	GMT	Standard Time	Greenwich Mean Time: Dublin, Edinburgh, Lisbon, London
		Greenwich Standard Time	Casablanca, Monrovia
14	GMT+01:00	Central Europe Standard Time	Belgrade, Bratislava, Budapest, Ljubljana, Prague
		Central European Standard Time	Sarajevo, Skopje, Sofija, Vilnius, Warsaw, Zagreb
		Romance Standard Time	Brussels, Copenhagen, Madrid, Paris
		W. Central Africa Standard Time	West Central Africa
		W. Europe Standard Time	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
15	GMT+02:00	E. Europe Standard Time	Bucharest
		Egypt Standard Time	Cairo
		FLE Standard Time	Helsinki, Riga, Tallinn
		GTB Standard Time	Athens, Istanbul, Minsk
		Israel Standard Time	Jerusalem
		South Africa Standard Time	Harare, Pretoria

Table 16 - Time Zone Information

Value	Offset from GMT	Time Zone Name	Areas in Time Zone
16	GMT+03:00	Arab Standard Time	Kuwait, Riyadh
		Arabic Standard Time	Baghdad
		E. Africa Standard Time	Nairobi
		Russian Standard Time	Moscow, St. Petersburg, Volgograd
17	GMT+03:30	Iran Standard Time	Tehran
18	GMT+04:00	Arabian Standard Time	Abu Dhabi, Muscat
		Caucasus Standard Time	Baku, Tbilisi, Yerevan
19	GMT+04:30	Afghanistan Standard Time	Kabul
20	GMT+05:00	Ekaterinburg Standard Time	Ekaterinburg
		West Asia Standard Time	Islamabad, Karachi, Tashkent
21	GMT+05:30	India Standard Time	Calcutta, Chennai, Mumbai, New Delhi
22	GMT+05:45	Nepal Standard Time	Kathmandu
23	GMT+06:00	Central Asia Standard Time	Astana, Dhaka
		N. Central Asia Standard Time	Almaty, Novosibirsk
		Sri Lanka Standard Time	Sri Jayawardenepura
24	GMT+06:30	Myanmar Standard Time	Rangoon
25	GMT+07:00	North Asia Standard Time	Krasnoyarsk
		SE Asia Standard Time	Bangkok, Hanoi, Jakarta
26	GMT+08:00	China Standard Time	Beijing, Chongqing, Hong Kong, Urumqi
		North Asia East Standard Time	Irkutsk, Ulaan Bataar
		Singapore Standard Time	Kuala Lumpur, Singapore
		Taipei Standard Time	Taipei
		W. Australia Standard Time	Perth
27	GMT+09:00	Korea Standard Time	Seoul
		Tokyo Standard Time	Osaka, Sapporo, Tokyo
		Yakutsk Standard Time	Yakutsk
28	GMT+09:30	AUS Central Standard Time	Darwin
		Cen. Australia Standard Time	Adelaide
29	GMT+10:00	AUS Eastern Standard Time	Canberra, Melbourne, Sydney
		E. Australia Standard Time	Brisbane
		Tasmania Standard Time	Hobart
		Vladivostok Standard Time	Vladivostok
		West Pacific Standard Time	Guam, Port Moresby
30	GMT+11:00	Central Pacific Standard Time	Magadan, Solomon Is., New Caledonia
31	GMT+12:00	Fiji Standard Time	Fiji, Kamchatka, Marshall Is.
		New Zealand Standard Time	Auckland, Wellington
32	GMT+13:00	Tonga Standard Time	Nuku'alofa

Date and Time Configuration

Table 17 - Table Properties

CSP File No.	N14
CIP Instance	7
Applies to	All models
No. of Elements	8
No. of Words	8
Data Type	Integer
Data Access	Read/Write

Table 18 - Date and Time Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40401	Table Password	0	0…9999	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	40402	Date: Year	2005	2001… 2100	The range is from 2001… 2100. A write sets the current year.
2	40403	Date: Month	1	1…12	A write sets the current month. A read returns current month. 1=January, 2=February,…12=December
3	40404	Date: Day	1	1…31	A write sets the current day of the month. A read returns the current day of the month. The internal real-time clock adjusts the date for leap-year.
4	40405	Time: Hour	0	0…23	A write sets the current hour. A read returns the current hour. 0=12am, 1=1am,…23=11pm The internal real-time clock does not adjust for daylight saving time.
5	40406	Time: Minute	0	0…59	A write sets the current minutes. A read returns the current minutes.
6	40407	Time: Seconds	0	0…59	A write sets the current seconds. A read returns the current seconds.
7	40408	Time: Hundredths	0	0…99	Set this element to 0 for writes. Returns hundredths of a second on read.

Log Configuration

Table 19 - Table Properties

CSP File No.	N15
CIP Instance	8
No. of Elements	12
No. of Words	12
Data Type	Integer
Data Access	Read/Write

Table 20 - Log Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
0	40501	Table Password	0	0… 9999	•	•	•	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	40502	Energy Log Interval	15 min	-1…60 0...60 (BC3,TS3)	•	•	•	Selects how often a record is logged (minutes). A value of 0 disables periodic logging of records. A value of –1 causes logging of records to be synchronized to the end of the demand interval.
2	40503	Energy Log Mode	1	0…1	•	•	•	This parameter sets the action of the log once it has filled to capacity. Setting the option to 0 allows the log to fill but stops at the end. Option 1 lets the log fill and then oldest records are deleted and replaced with new records. 0 = Fill and Stop 1 = Overwrite, When the log is filled new records replace the oldest records.
3	40504	Time of Use Log Auto Log Setting	31	0…31	•	•	•	Automatically stores the current record for the month replacing the oldest record if the log is full. The log holds 12 months plus the current record. 0 = Disables the auto clear feature. 1 = Store and clear the table on the 1st day of each month. 2 = 2nd Day 3 = 3rd day … 29…31 = Store and clear table at the last day of the month.

Table 20 - Log Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
4	40505	Off Peak Days	65	0…127	•	•	•	This bit map field selects the off peak days. OFF-PEAK days have only one rate for billing. Bit0= Sunday Bit1= Monday Bit2= Tuesday Bit3= Wednesday Bit4= Thursday Bit5= Friday Bit6= Saturday Saturday and Sunday are default Off Peak days.
5	40506	MID Peak AM Hours	1792	0… 4095	•	•	•	This bit map selects any AM hours that are designated as MID Peak. Example: The hours from 8 AM to 11AM is designated as bit 8 through bit 10 = 1792d. Bit0= 12 AM…1 AM Bit1= 1 AM…2 AM Bit2= 2 AM…3 AM … … Bit11= 11AM…12 PM Default is 8 AM…11 AM
6	40507	MID Peak PM Hours	120	0… 4095	•	•	•	This bit map selects any PM hours that are designated as MID Peak. Example: The hours from 3 PM to 7 PM is designated as bit 3 through bit 6 = 120d. Bit0= 12 PM…1 PM Bit1= 1 PM…2 PM Bit2= 2 PM…3 PM … … Bit11= 11PM…12 AM Default is 3 PM…7 PM
7	40508	ON Peak AM Hours	2048	0… 4095	•	•	•	This bit map selects any AM hours that are designated as ON Peak. Example: The hours from 11AM to 12 PM is designated as bit 11 = 2048d. Bit0= 12 AM…1 AM Bit1= 1 AM…2 AM Bit2= 2 AM…3 AM … Bit11= 11AM…12 PM Default is 11AM
8	40509	ON Peak PM hours	7	0…4095	•	•	•	This bit map selects any PM hours that are designated as ON Peak. Example: The hours from 12 PM to 3 PM is designated as bit 0 through bit 2 = 7d Bit0= 12 PM…1 PM Bit1= 1 PM…2 PM Bit2= 2 PM…3 PM … Bit11= 11PM…12 AM Default is 12 PM…3 PM

Table 20 - Log Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
9	40510	Load Factor log Auto Log Setting	31	0…31			•	Automatically stores the current peak, average, and load factor results as a record in the non-volatile load factor log and resets the log at the specified day of the month. 0 = Disables the auto clear feature. 1 = Store and clear the table on the 1st day of each month. 2 = 2nd Day 3 = 3rd day … 29…31 = Store and clear table at the last day of the month.
10	40511	Reserved	0	0	•	•	•	Reserved for future use.
11	40512	Reserved	0	0	•	•	•	Reserved for future use.

Command Table

Table 21 - Table Properties

CSP File No.	F16
CIP Instance	9
No. of Elements	22
No. of Words	44
Data Type	Float
Data Access	Write

Table 22 - Command Table

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
0	40601-2	Table Password	0	0…9999	•	•	•	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1 🔒	40603-4	Command Word 1	0	0…32	•	•	•	These commands can be sent to the power monitor. When using the optional elements the command table must be sent complete with all elements present. If the single password table is used to gain access to configuration items then the command can be sent alone without optional settings. The command options are:
					•	•	•	0 = No Action
					•	•	•	1 = Set kWh Register
					•	•	•	2 = Set kVARh Register
					•	•	•	3 = Set kVAh Register
					•	•	•	4 = Clear All Energy Registers
						•	•	5 = Set Status 1 Count
						•	•	6 = Set Status 2 Count
					•	•	•	7 = Clear Energy Log
						•	•	8 = Force KYZ Output On
						•	•	9 = Force KYZ Output Off
						•	•	10 = Remove Force from KYZ
					•	•	•	11 = Restore Factory Defaults
					•	•	•	12 = Perform Wiring Diagnostics
					•	•	•	13 = Reset power monitor System
					•	•	•	14…32 = Reserved If a command is received that is not supported by your catalog number the command is ignored.

Table 22 - Command Table

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
2	40605-6	Command Word 2	0	0…32	•	•	•	0 = No Action
					•	•	•	1 = Clear Min/Max Records
							•	2 = Store and clear current Load Factor Record
							•	3 = Clear Load Factor Log
					•	•	•	4 = Store and clear current TOU Record
					•	•	•	5 = Clear TOU Log
					•	•	•	6 = Clear Error Log command
					•	•		7 = Troubleshooting Mode Enable
					•	•	•	8 = Log Off
					•	•	•	9…32 = Reserved. If a command is received that is not supported by your catalog number the command is ignored.
3	40607-8	Clear Single Min/ Max Records	0	0…35 (EM3) 0…31 (TS3) 0 or 16…31 (BC3)	•	•	•	When setting the Min/Max Clear bit this value can be sent to specify a single parameter. If clearing all values this is not required. 0 = Clear All Parameters 1 = Clear the 1st Min/Max Record 2 = Clear the 2nd Min/Max Record … 35 = Clear the 35th Min/Max Record
4	40609-10	Status 1 Count x M Register Set Value	0	0… 9,999,999		•	•	Status 1 Count Register Start Value x 1,000,000
5	40611-12	Status 1 Count X 1 Register Set Value	0	0… 999,999		•	•	Status 1 Count Register Start Value x 1
6	40613-14	Status 2 Count x M Register Set Value	0	0… 9,999,999		•	•	Status 2 Count Register Start Value x 1,000,000
7	40615-16	Status 2 Count X 1 Register Set Value	0	0… 999,999		•	•	Status 2 Count Register Start Value x 1
8	40617-18	GWh Fwd Register Set Value	0	0… 9,999,999	•	•	•	Sets the GWh Fwd Register to the desired Value
9	40619-20	kWh Fwd Register Set Value	0	0… 999,999	•	•	•	Sets the kWh Fwd Register to the desired Value
10	40621-22	GWh Rev Register Set Value	0	0… 9,999,999	•	•	•	Sets the GWh Rev Register to the desired Value
11	40623-24	kWh Rev Register Set Value	0	0… 999,999	•	•	•	Sets the kWh Rev Register to the desired Value
12	40625-26	GVARh Fwd Register Set Value	0	0… 9,999,999	•	•	•	Sets the GVARh Fwd Register to the desired Value
13	40627-28	kVARh Fwd Register Set Value	0	0… 999,999	•	•	•	Sets the kVARh Fwd Register to the desired Value
14	40629-30	GVARh Rev Register Set Value	0	0… 9,999,999	•	•	•	Sets the GVARh Rev Register to the desired Value
15	40631-32	kVARh Rev Register Set Value	0	0… 999,999	•	•	•	Sets the kVARh Rev Register to the desired Value
16	40633-34	GVAh Register Set Value	0	0… 9,999,999	•	•	•	Sets the GVAh Register to the desired Value

Table 22 - Command Table

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
17	40635-36	kVAh Register Set Value	0	0… 999,999	•	•	•	Sets the kVAh Register to the desired Value
18	40637-38	Troubleshooting Mode Password	0	0	•	•	•	Password for Troubleshooting Mode provided by Rockwell Automation.
19	40639-40	Reserved	0	0	•	•	•	Reserved for future use.
20	40641-42	Reserved	0	0	•	•	•	Reserved for future use.
21	40643-44	Reserved	0	0	•	•	•	Reserved for future use.

Log Request Table

Table 23 - Table Properties

CSP File No.	N17
CIP Instance	10
No. of Elements	11
No. of Words	11
Data Type	Integer
Data Access	Read/Write

Table 24 - Log Request Table

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
0	40701	Selected Log	0	0…9	•	•	•	Selects the log that information is returned from. Once a single request has been made, the auto return feature brings back successive records each time the log is read. Some logs support individual record requests. IMPORTANT: If your catalog number does not support the requested log item, the power monitor ignores the request.
					•	•	•	0 = No Log Selected
					•	•	•	1 = Unit Status Log
					•	•	•	2 = Min/Max Log
					•	•	•	3 = Energy Log
							•	4 = Load Factor Log
					•	•	•	5 = Time of Use Log kWh
					•	•	•	6 = Time of Use Log kVARh
					•	•	•	7 = Time of Use Log kVAh
					•	•	•	8 = Internal Error Log
							•	9 = Alarm Log
1	40702	Chronology of Auto Return Data	1	0…1	•	•	•	The date chronology of the returned records. 0 = Reverse direction 1 = Forward direction
2	40703	The Min/Max record to be returned	0	0…35 (EM3) 0…31 (TS3) 0 or 16…31 (BC3)	•	•	•	Selects the Min/Max record number to be returned. See the table for Min/Max record list. 0 = Use incremental return and the chronology selected.
3	40704	Number of Unit Status Records	-	1…50	•	•	•	On a read of this table the value of this parameter is the number of Unit Status Records available. This log is only returned using the incremental return method.

Table 24 - Log Request Table

Element No.	Modbus Address	Element Name	Default Value	Range	BC3	TS3	EM3	Description
4	40705	Number of Energy Log Records	-	0… 17,280	•	•	•	On a read of this table the value of this parameter is the number of Energy Log Records available.
5	40706	Number of Time of Use Log Records	-	1…13	•	•	•	On a read of this table the value of this parameter is the number of Time of Use Log Records available. One is the current record being updated before logging.
6	40707	Number of Load Factor Log Records	-	1…13			•	On a read of this table the value of this parameter is the number of Load Factor Log Records available. One is the current record being updated before logging.
7	40708	Load Factor or TOU Record to be Returned.	-	0…13	•	•	•	Selects the Load Factor or TOU record number to be returned. 0 = Use incremental return and the chronology selected 1 through 13 selects an individual record.
8	40709	Internal Error Log Records	-	1…20	•	•	•	On a read of this table the value of this parameter is the number of Internal Error Log Records available.
9	40710	Alarm Log Records	-	1…50			•	On a read of this table the value of this parameter is the number of Alarm Log Records available.
10	40711	Reserved	0	0	•	•	•	Reserved for future use.

Controller Interface Table

Table 25 - Table Properties

CSP File No.	N18
CIP Instance	11
Applies to	EM3 only
No. of Elements	8
No. of Words	8
Data Type	Integer
Data Access	Write

Table 26 - Controller Interface Table

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40801	Table Password	0	0…9999	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	40802	Controller Command Word	0	0…1	Bit 0 = When this bit is written to the power monitor it signals the end of the demand period. The power monitor resets the bit to 0 and sends the end of demand broadcast to all of the slaves configured for the master/slave demand system. The power monitor must be configured as a Master for external demand pulse input. Bit 1…15 = Reserved
2	40803	Reserved	0	0	Reserved for future use.
3	40804	Reserved	0	0	Reserved for future use.
4	40805	Reserved	0	0	Reserved for future use.
5	40806	Reserved	0	0	Reserved for future use.
6	40807	Reserved	0	0	Reserved for future use.
7	40808	Reserved	0	0	Reserved for future use.

Discrete Results

Table 27 - Table Properties

CSP File No.	N19
CIP Instance	12
Applies to	All models
No. of Elements	6
No. of Words	6
Data Type	Integer
Data Access	Read

Table 28 - Discrete Results

Element No.	Modbus Address	Element Name	Range	Description
0[1]	30001	Status Input States	0…3	Indicates the current states of the status input. Bit 0 = Status 1 activated Bit 1 = Status 2 activated Bit 2…15 = Reserved
1[2]	30002	Output Word	0…31	Bit 0 = KYZ relay actuated Bit 1 = KYZ output forced on Bit 2 = KYZ output forced off Bit 3 = External demand pulse timeout Bit 4 = Terminal Locked Bit 5…15 = Reserved
2	30003	Reserved	0	Reserved for future use.
3	30004	Reserved	0	Reserved for future use.
4	30005	Reserved	0	Reserved for future use.
5	30006	Reserved	0	Reserved for future use.

(1) Element 0 is not available for BC3.

(2) Only Bit 4 supported on BC3 model.

Wiring Diagnostics Results

Table 29 - Table Properties

CSP File No.	F20
CIP Instance	13
No. of Elements	21
No. of Words	42
Data Type	Float
Data Access	Read

Table 30 - Wiring Diagnostics Results

Element No.	Modbus Address	Element Name	Units	Range	BC3	TS3	EM3	Description
0	30101-2	Wiring Status		0…5	•	•	•	This is the overall status of the wiring diagnostic test. 0 = Pass 1 = Failed 2 = Input Level Low 3 = Disabled 4 = Waiting Command 5 = Out of range
1	30103-4	Voltage Input Missing		-1…123	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 missing 2 = Phase 2 missing 3 = Phase 3 missing 12 = Phase 1 and 2 missing 13 = Phase 1 and 3 missing 23 = Phase 2 and 3 missing 123 = All phases missing
2	30105-6	Voltage Input Inverted		-1…123	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 inverted 2 = Phase 2 inverted 3 = Phase 3 inverted 12 = Phase 1 and 2 inverted 13 = Phase 1 and 3 inverted 23 = Phase 2 and 3 inverted 123 = All phases inverted
3	30107-8	Current Input Missing		-1…123	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 missing 2 = Phase 2 missing 3 = Phase 3 missing 12 = Phase 1 and 2 missing 13 = Phase 1 and 3 missing 23 = Phase 2 and 3 missing 123 = All phases missing

Table 30 - Wiring Diagnostics Results

Element No.	Modbus Address	Element Name	Units	Range	BC3	TS3	EM3	Description
4	30109-10	Current Input Inverted		-1…123	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 inverted 2 = Phase 2 inverted 3 = Phase 3 inverted 12 = Phase 1 and 2 inverted 13 = Phase 1 and 3 inverted 23 = Phase 2 and 3 inverted 123 = All phases inverted
5	30111-12	Voltage Rotation		-1…132	•	•	•	Reports on all three phases. The reported sequence represents each phase. Example: 123 = Phase 1 then phase 2 then phase 3 -1 = Test not run 4 = Invalid rotation 1…132 designating phase and rotation.
6	30113-14	Current Rotation		-1…321	•	•	•	Reports on all three phases. The reported sequence represents each phase. Example: 123 = Phase 1 then phase 2 then phase 3 -1 = Test not run 4 = Invalid rotation 1…321 designating phase and rotation.
7	30115-16	Voltage Phase 1 Angle (degrees)	Degrees	0…359.99	•	•	•	Shows the present phase angle of this channel. Always is 0 degrees for voltage phase 1.
8	30117-18	Voltage Phase 1 Magnitude (volts)	Volts	0…9,999,999		•	•	Shows the present magnitude of this phase.
9	30119-20	Voltage Phase 2 Angle (degrees)	Degrees	0…359.99	•	•	•	Shows the present phase angle of this channel.
10	30121-22	Voltage Phase 2 Magnitude (volts)	Volts	0…9,999,999		•	•	Shows the present magnitude of this phase.
11	30123-24	Voltage Phase 3 Angle (degrees)	Degrees	0…359.99	•	•	•	Shows the present phase angle of this channel.
12	30125-26	Voltage Phase 3 Magnitude (volts)	Volts	0…9,999,999		•	•	Shows the present magnitude of this phase.
13	30127-28	Current Phase 1 Angle (degrees)	Degrees	0…359.99	•	•	•	Shows the present phase angle of this channel.
14	30129-30	Current Phase 1 Magnitude (amperes)	Amperes	0…9,999,999		•	•	Shows the present magnitude of this phase.
15	30131-32	Current Phase 2 Angle (degrees)	Degrees	0…359.99	•	•	•	Shows the present phase angle of this channel.
16	30133-34	Current Phase 2 Magnitude (amperes)	Amperes	0…9,999,999		•	•	Shows the present magnitude of this phase.
17	30135-36	Current Phase 3 Angle (degrees)	Degrees	0…359.99	•	•	•	Shows the present phase angle of this channel.
18	30137-38	Current Phase 3 Magnitude (amperes)	Amperes	0…9,999,999		•	•	Shows the present magnitude of this phase.
19	30139-40	Degrees out of range		0…360	•	•	•	When Status = 5, how many degrees out of range.
20	30141-42	Reserved		0	•	•	•	Reserved for future use

Volts Amps Frequency Results

Table 31 - Table Properties

CSP File No.	F21
CIP Instance	14
No. of Elements	16
No. of Words	32
Data Type	Float
Data Access	Read

Table 32 - Volts Amps Frequency Results

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	30201-2	L1 Current	0.000…9,999,999		•	•	Phase 1 scaled RMS Current
1	30203-4	L2 Current	0.000…9,999,999		•	•	Phase 2 scaled RMS Current
2	30205-6	L3 Current	0.000…9,999,999		•	•	Phase 3 scaled RMS Current
3	30207-8	Average Current	0.000…9,999,999		•	•	Average RMS Current
4	30209-10	L1-N Volts	0.000…9,999,999		•	•	Phase 1 scaled RMS Voltage
5	30211-12	L2-N Volts	0.000…9,999,999		•	•	Phase 2 scaled RMS Voltage
6	30213-14	L3-N Volts	0.000…9,999,999		•	•	Phase 3 scaled RMS Voltage
7	30215-16	Average L-N Volts	0.000…9,999,999		•	•	Averaged RMS Voltage
8	30217-18	L1-L2 Volts	0.000…9,999,999		•	•	Line 1 to Line 2 Volts
9	30219-20	L2-L3 Volts	0.000…9,999,999		•	•	Line 2 to Line 3 Volts
10	30221-22	L3-L1 Volts	0.000…9,999,999		•	•	Line 3 to Line 1 Volts
11	30223-24	Average L-L Volts	0.000…9,999,999		•	•	Average Line to Line Volts
12	30225-26	Frequency	40.0 Hz…70.0 Hz		•	•	Last frequency reading.
13	30227-28	Percent Current Unbalance	0.0…100.0		•	•	Percent maximum deviation from Ave. / Ave.
14	30229-30	Percent Voltage Unbalance	0.0…100.0		•	•	Percent Maximum deviation from Ave. / Ave.
15	30231-32	Metering Iteration	0…9,999,999		•	•	Increments by 1 for each new metering calculation.

Power Results

Table 33 - Table Properties

CSP File No.	F22
CIP Instance	15
No. of Elements	17
No. of Words	34
Data Type	Float
Data Access	Read

Table 34 - Power Results

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	30301-2	L1 True Power Factor	-100.0…+100.0	•	•	•	Percent ratio between power and apparent power. The value is signed to (+) leading and (-) lagging.
1	30303-4	L2 True Power Factor	-100.0…+100.0	•	•	•	
2	30305-6	L3 True Power Factor	-100.0…+100.0	•	•	•	
3	30307-8	3 Phase True Power Factor	-100.0…+100.0	•	•	•	
4	30309-10	L1 kW	± 0.000…9,999,999	•	•	•	Line 1 kW
5	30311-12	L2 kW	± 0.000…9,999,999	•	•	•	Line 2 kW
6	30313-14	L3 kW	± 0.000…9,999,999	•	•	•	Line 3 kW
7	30315-16	Total kW	± 0.000…9,999,999	•	•	•	Total kW
8	30317-18	L1 kVAR	± 0.000…9,999,999	•	•	•	Line 1 kVAR
9	30319-20	L2 kVAR	± 0.000…9,999,999	•	•	•	Line 2 kVAR
10	30321-22	L3 kVAR	± 0.000…9,999,999	•	•	•	Line 3 kVAR
11	30323-24	Total kVAR	± 0.000…9,999,999	•	•	•	Total kVAR
12	30325-26	L1 kVA	0.000…9,999,999	•	•	•	Line 1 kVA
13	30327-28	L2 kVA	0.000…9,999,999	•	•	•	Line 2 kVA
14	30329-30	L3 kVA	0.000…9,999,999	•	•	•	Line 3 kVA
15	30331-32	Total kVA	0.000…9,999,999	•	•	•	Total kVA
16	30333-34	Metering Iteration	0…9,999,999	•	•	•	Increments by 1 for each new metering calculation.

IMPORTANT Only total power values are returned in delta wiring modes. Zeroes are returned for individual phase values.

Energy Results

Table 35 - Table Properties

CSP File No.	F23
CIP Instance	16
No. of Elements	19
No. of Words	38
Data Type	Float
Data Access	Read

Table 36 - Energy Results

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	30401-2	Status 1 Count xM	0…9,999,999		•	•	Status 1 Count times 1,000,000
1	30403-4	Status 1 Count x1	0…999,999		•	•	Status 1 count times 1
2	30405-6	Status 2 Count xM	0…9,999,999		•	•	Status 2 Count times 1,000,000
3	30407-8	Status 2 Count x1	0…999,999		•	•	Status 2 count times 1
4	30409-10	GWh Fwd	0…9,999,999	•	•	•	Forward gigawatt hours
5	30411-12	kWh Fwd	0.000…999,999	•	•	•	Forward kilowatt hours
6	30413-14	GWh Rev.	0…9,999,999	•	•	•	Reverse gigawatt hours
7	30415-16	kWh Rev.	0.000…999.999	•	•	•	Reverse kilowatt hours
8	30417-18	GWh Net	± 0…9,999,999	•	•	•	Net gigawatt hours
9	30419-20	kWh Net	± 0.000…999,999	•	•	•	Net kilowatt hours
10	30421-22	GVARH Fwd	0…9,999,999	•	•	•	Forward gigaVAR hours
11	30423-24	kVARh Fwd	0.000…999,999	•	•	•	Forward kiloVAR hours
12	30425-26	GVARH Rev.	0…9,999,999	•	•	•	Reverse gigaVAR hours
13	30427-28	kVARh Rev.	0.000…999,999	•	•	•	Reverse kiloVAR hours
14	30429-30	GVARH Net	± 0…9,999,999	•	•	•	Net gigaVAR hours
15	30431-32	kVARh Net	± 0.000…999,999	•	•	•	Net kiloVAR hours
16	30433-34	GVAh Net	0…9,999,999	•	•	•	Net gigaVA hours
17	30435-36	kVAh Net	0.000…999,999	•	•	•	Net kiloVA hours
18	30437-38	Metering Iteration	0…9,999,999	•	•	•	Increments by 1 for each new metering calculation.

Demand Results

Table 37 - Table Properties

CSP File No.	F24
CIP Instance	17
No. of Elements	9
No. of Words	18
Data Type	Float
Data Access	Read

Table 38 - Demand Results

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	30501-2	kW Demand	± 0.000…9,999,999			•	The average real power during the last demand period.
1	30503-4	kVAR Demand	± 0.000…9,999,999			•	The average reactive power during the last demand period.
2	30505-6	kVA Demand	0.000…9,999,999			•	The average apparent power during the last demand period.
3	30507-8	Demand PF	-100.0…+100.0			•	The average demand for PF during the last demand period.
4	30509-10	Projected kW Demand	± 0.000…9,999,999			•	The projected total real power for the current period.
5	30511-12	Projected kVAR Demand	± 0.000…9,999,999			•	The projected total reactive power for the current period.
6	30513-14	Projected kVA Demand	0.000…9,999,999			•	The projected total apparent power for the current period.
7	30515-16	Elapsed Demand Period Time	0.00…99.99			•	The amount of time that has elapsed during the current period.
8	30517-18	Metering Iteration	0…9,999,999			•	Increments by 1 for each new metering calculation.

Unit Status Log Results

Table 39 - Table Properties

CSP File No.	N25
CIP Instance	18
Applies to	All models
No. of Elements	13
No. of Words	13
Data Type	Integer
Data Access	Read

Table 40 - Unit Status Log Results

Element No.	Modbus Address	Element Name	Range	Description
0	30601	Status Record Internal Identifier	1…50	Used to verify record sequence when returning multiple records.
1	30602	Timestamp Year of record	-	The year when the record was recorded.
2	30603	Timestamp Month/Day	-	The month and day when the record was recorded.
3	30604	Timestamp Hour/Minute	-	The hour and minute when the record was recorded.
4	30605	Timestamp Seconds/Hundredths	-	The seconds and hundredths when the record was recorded.
5	30606	Status Event Type	0…512	Indicates the type of status event that has occurred.
6	30607	General Code	0…4096	Indicates general information about the status event.
7	30608	Information Code	0…256	Indicates specific information about the status event.
8	30609	Reserved	0	Reserved for future use.
9	30610	Reserved	0	Reserved for future use.
10	30611	Reserved	0	Reserved for future use.
11	30612	Reserved	0	Reserved for future use.
12	30613	Reserved	0	Reserved for future use.

Table 41 - Unit Status Log Codes

Status Event Type (Decimal)	Event #	General Code (Decimal)	Code #	Information Code (Decimal)	BC3	TS3	EM3	Code #
Self Test Status	1	Pass	0		•	•	•	
		Flash Memory	1	Overall Status	•	•	•	1
				Boot Code Checksum	•	•	•	2
				Application Code Checksum	•	•	•	4
				Calibration Data CRC	•	•	•	8
				No Calibration Data	•	•	•	16
				Wrong Application FRN	•	•	•	32
				Invalid Model Type	•	•	•	64
				WIN Mismatch	•	•	•	128
				Missing Upgrade Block	•	•	•	256
		SRAM	2	Failed Read/Write Test	•	•	•	1
		NVRAM	4	Failed Read/Write Test	•	•	•	1
		SPI Interface	8	SPI Device Not Responding	•	•	•	1
				SPI Interface Failed	•	•	•	2
		Real Time Clock	16	Real Time Clock Failed	•	•	•	1
				Real Time Clock not Set	•	•	•	2
		Watchdog Timer	32	Watchdog Time Out	•	•	•	1
		Metering	64	Metering Status Failed	•	•	•	1
		LCD Interface	128	LCD Interface Failure		•	•	1
		Serial Communication	256	Serial Communication Port Failed	•	•	•	1
		Ethernet Communication	512	Ethernet Communication Port Failed	•	•	•	1
				Modbus Stack Initialization Failed	•	•	•	2
				Demand Broadcast Thread Init Failed			•	4
				SNTP Thread Init Failed	•	•	•	8
		Input Over Range	1024	Input Over Range Voltage	•	•	•	1
				Input Over Range Current	•	•	•	2
		Voltage Phase Loss	2048	Voltage Channel 1 Loss	•	•	•	1
				Voltage Channel 2 Loss	•	•	•	2
				Voltage Channel 3 Loss	•	•	•	4
		Process Error	4096		•	•	•	

Table 41 - Unit Status Log Codes

Status Event Type (Decimal)	Event #	General Code (Decimal)	Code #	Information Code (Decimal)	BC3	TS3	EM3	Code #
Configuration Changed	2	Clock Set	1		•	•	•	
		Status Input Counter Set	2	Status Input 1		•	•	1
				Status Input 2		•	•	2
				All Status Input		•	•	4
		Factory Defaults Restored	4		•	•	•	
		Energy Register Set	8	Wh Register	•	•	•	1
				VARh Register	•	•	•	2
				VAh Register	•	•	•	4
				All Energy Registers Cleared	•	•	•	8
		Terminal Locked	16		•	•	•	
		Terminal Unlocked	32		•	•	•	
Log Cleared or Set	4	Min/Max Log Cleared	1		•	•	•	
		Energy Log Cleared	2		•	•	•	
		LoadFactor Log Cleared	4				•	
		TOU Log Cleared	8		•	•	•	
Relay/KYZ Output Forced	8	KYZ Forced On	1			•	•	
		KYZ Forced Off	2			•	•	
Status Input Activated	16	Status Input 1	1			•	•	
		Status Input 2	2			•	•	
Status Input Deactivated	32	Status Input 1	1			•	•	
		Status Input 2	2			•	•	
Energy Register Rollover	64	Wh Register	1		•	•	•	
		VARh Register	2		•	•	•	
		VAh Register	4		•	•	•	
		Status Input 1 Register	8			•	•	
		Status Input 2 Register	16			•	•	
Device Power Up	128				•	•	•	
Device Power Down	256				•	•	•	
Missed External Demand Sync	512						•	

Energy Log Results

Table 42 - Table Properties

CSP File No.	F26
CIP Instance	19
No. of Elements	21
No. of Words	42
Data Type	Float
Data Access	Read

Table 43 - Energy Log Results

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	30701-2	Internal Record Identifier.		•	•	•	Used to verify record sequence when returning multiple records.
1	30703-4	Timestamp Year of record	-	•	•	•	The date and time when the record was recorded.
2	30705-6	Timestamp Month/ Day	-	•	•	•	
3	30707-8	Timestamp Hour/ Minute	-	•	•	•	
4	30709-10	Timestamp Seconds/ Hundredths	-	•	•	•	
5	30711-12	Status 1 Count xM	0…9,999,999		•	•	Status 1 Count times 1,000,000
6	30713-14	Status 1 Count x1	0…999,999		•	•	Status 1 count times 1
7	30715-16	Status 2 Count xM	0…9,999,999		•	•	Status 2 Count times 1,000,000
8	30717-18	Status 2 Count x1	0…999,999		•	•	Status 2 count times 1
9	30719-20	GWh Net	± 0…9,999,999	•	•	•	Net gigawatt hours
10	30721-22	kWh Net	± 0.000…999,999	•	•	•	Net kilowatt hours
11	30723-24	GVARH Net	± 0…9,999,999	•	•	•	Net gigaVAR hours
12	30725-26	kVARh Net	± 0.000…999,999	•	•	•	Net kiloVAR hours
13	30727-28	GVAh Net	0…9,999,999	•	•	•	Net gigaVA hours
14	30729-30	kVAh Net	0.000…999,999	•	•	•	Net kiloVA hours
15	30731-32	kW Demand	± 0.000…9,999,999			•	The average real power during the last demand period.
16	30733-34	kVAR Demand	± 0.000…9,999,999			•	The average reactive power during the last demand period.
17	30735-36	kVA Demand	0.000…9,999,999			•	The average apparent power during the last demand period.
18	30737-38	Demand PF	-100.0…+100.0			•	The average demand for PF during the last demand period.
19	30739-40	Reserved	0	•	•	•	Reserved for future use.
20	30741-42	Reserved	0	•	•	•	Reserved for future use.

Write Error Status Results

Table 44 - Table Properties

CSP File No.	N27
CIP Instance	20
Applies to	All Models
No. of Elements	3
No. of Words	3
Data Type	Integer
Data Access	Read

Table 45 - Write Error Status Results

Element No.	Modbus Address	Element Name	Range	Description
0	30801	Table Number or Instance	All Write Enabled Tables	Indicates the last table that was written.
1	30802	Offending Element	Length of current table - 1	If the most recent write was successful this returns a (-1). If the write was unsuccessful this is the first rejected element in the table write.
2	30803	Write Error Status Word	0…32767	Bit 0 = Configuration_Lock_On Bit 1 = Password_is_not_validated Bit 2 = Admin_Name_Or_Password_Rejected Bit 3 = Admin_Password_Active Bit 4 = Application_Name_Or_Password_Rejected Bit 5 = Application_Password_Active Bit 6 = Web_Security_Status 0: Web security disabled 1: Web security enabled Bit 7 = Application_Security_Status 0: Application security disabled 1: Application security enabled

Unit Run Status Results

Table 46 - Table Properties

CSP File No.	N28
CIP Instance	21
Applies to	All models
No. of Elements	25
No. of Words	25
Data Type	Integer
Data Access	Read

Table 47 - Unit Run Status Results

Element No.	Modbus Address	Element Name	Range	Description
0	30901	Bulletin Number	1408	Always returns 1408
1	30902	Series Letter	0…8	Indicates the unit hardware series letter, for example. 0 = A 1 = B . . 8 = I
2	30903	Catalog Device Type	0…7	The catalog number type of this device. 0 = TR1 1 = TR2 2 = EM1 3 = EM2 4 = EM3 5 = BC3 6 = TS3 7 = SP3
3	30904	Communication Type	0…1	The communication type of this device 0 = Serial only 1 = both serial and Ethernet
4	30905	Application FRN	-	The current firmware revision
5	30906	Boot Code FRN	-	The current boot code revision
6	30907	Default Device ID	1…247	A semi-unique number assigned to a device at the time it is manufactured. Used for out of the box communication over DF1 and Ethernet.
7	30908	Accuracy Class	0…3	Indicates the revenue metering accuracy class of the power monitor as it is shipped from the factory. 0 = No Class Designation 1 = Class 1 2 = Class 0.5 3 = Class 0.2

Table 47 - Unit Run Status Results

Element No.	Modbus Address	Element Name	Range	Description
8	30909	Overall Status	0…16383	0 indicates normal operation. Each bit indicates a different fault condition. Bit 0 = Flash Memory Bit 1 = SRAM Bit 2 = NVRAM Bit 3 = SPI Interface Bit 4 = Real Time Clock Bit 5 = Watchdog Timer Bit 6 = Metering Bit 7 = LCD Interface Bit 8 = Serial Communications Bit 9 = Ethernet Communications Bit 10 = Error Log Full
9	30910	Flash Memory	0…511	0 indicates normal operation. Status bits are Bit 0 = Overall status Bit 1 = Boot code checksum Bit 2 = Application code checksum Bit 3 = Calibration data CRC Bit 4 = No calibration data Bit 5 = Wrong application FRN Bit 6 = Invalid model type Bit 7 = WIN mismatch Bit 8 = missing upgrade block
10	30911	SRAM	0…1	0 indicates normal operation. Bit 0 = Read/write test
11	30912	NVRAM	0…1	0 indicates normal operation. Bit 0 = Read/write test
12	30913	SPI Interface	0…1	0 indicates normal operation. Bit 0 = SPI device not responding
13	30914	Real Time Clock	0…3	0 indicates normal operation. Bit 0 = RTC status Bit 1 = Time Zone Set Failed
14	30915	Watchdog Timer	0…1	0 indicates normal operation. Bit 0 = Watchdog time out
15	30916	Metering	0…1	0 indicates normal operation. Bit 0 = Metering status
16	30917	LCD Interface	0…1	0 indicates normal operation. Bit 0 = LCD Interface status
17	30918	Serial Communications	0…1	0 indicates normal operation. Bit 0 = Serial Interface status
18	30919	Ethernet Communications	0…511	0 indicates normal operation. Bit 0 = Ethernet Communications status Bit 1 = SNTP Server timeout status Bit 2 = Duplicate IP Address status Bit 3 = Invalid IP/Netmask address Bit 4 = Invalid gateway address Bit 5 = Invalid SNTP time server address Bit 6 = Modbus stack run status Bit 7 = Demand broadcast thread run status Bit 8 = SNTP thread run status
19	30920	Input Over Range	0…3	0 indicates normal operation. Bit 0 = Voltage Input over range Bit 1 = Current Input over range
20	30921	Phase Loss Detection	0…7	0 Indicates normal running condition. Bit 0 = Loss of phase A Bit 1 = Loss of phase B Bit 2 = Loss of phase C

Table 47 - Unit Run Status Results

Element No.	Modbus Address	Element Name	Range	Description
21	30922	Configuration Locked	0…1	Reports 1 if configuration lock is applied.
22	30923	Single Element Password Accepted	0…1	1 indicates the single element password is verified and active
23	30924	Error Recorded	0…20	Is incremented by 1 when an internal error happens
24	30925	Troubleshooting Mode Times Left	0…30	Remaining times for troubleshooting mode.

Min/Max Log Results

Table 48 - Table Properties

CSP File No.	F29
CIP Instance	22
Applies to	All models
No. of Elements	11
No. of Words	22
Data Type	Float
Data Access	Read

Table 49 - Min/Max Log Results

Element No.	Modbus Address	Element Name	Range	Description
0	31001-2	Parameter Being Returned	1…35	Indicates the Parameter Number (See Min/Max Parameter List).
1	31003-4	MIN Value	± 0.000…9,999,999	The minimum value recorded for parameter being returned since the last clear command.
2	31005-6	MAX Value	± 0.000…9,999,999	The maximum value recorded for parameter being returned since the last clear command.
3	31007-8	Timestamp Year of MIN		The year when the MIN value was recorded.
4	31009-10	Timestamp Month/Day of MIN		The month and day when the MIN value was recorded.
5	31011-12	Timestamp Hour/Minute of MIN		The hour and minute when the MIN value was recorded.
6	31013-14	Timestamp Seconds/ Hundredths of MIN		The seconds and hundredths when the MIN value was recorded.
7	31015-16	Timestamp Year of MAX		The year when the MAX value was recorded.
8	31017-18	Timestamp Month/Day of MAX		The month and day when the MAX value was recorded.
9	31019-20	Timestamp Hour/Minute of MAX		The hour and minute when the MAX value was recorded.
10	31021-22	Timestamp Seconds/ Hundredths of MAX		The seconds and hundredths when the MAX value was recorded.

Table 50 - Min/Max Parameter List

No.	Parameter	BC3	TS3	EM3
1	L1 Current		•	•
2	L2 Current		•	•
3	L3 Current		•	•
4	Average Current		•	•
5	L1-N Volts		•	•
6	L2-N Volts		•	•
7	L3-N Volts		•	•
8	Average L-N Volts		•	•
9	L1-L2 Volts		•	•
10	L2-L3 Volts		•	•
11	L3-L1 Volts		•	•
12	Average L-L Volts		•	•
13	Frequency		•	•
14	Percent Current Unbalance		•	•
15	Percent Voltage Unbalance		•	•
16	L1 True Power Factor	•	•	•
17	L2 True Power Factor	•	•	•
18	L3 True Power Factor	•	•	•
19	3 Phase True Power Factor	•	•	•
20	L1 kW	•	•	•
21	L2 kW	•	•	•
22	L3 kW	•	•	•
23	Total kW	•	•	•
24	L1 kVAR	•	•	•
25	L2 kVAR	•	•	•
26	L3 kVAR	•	•	•
27	Total kVAR	•	•	•
28	L1 kVA	•	•	•
29	L2 kVA	•	•	•
30	L3 kVA	•	•	•
31	Total kVA	•	•	•
32	kW Demand			•
33	kVAR Demand			•
34	kVA Demand			•
35	PF Demand			•

Load Factor Log Results

Table 51 - Table Properties

CSP File No.	F30
CIP Instance	23
Applies to	EM3 only
No. of Elements	14
No. of Words	28
Data Type	Float
Data Access	Read

Table 52 - Load Factor Log Results

Element No.	Modbus Address	Element Name	Range	Description
0	31101-2	Record Number	1…13	The record number of this data.
1	31103-4	End Date yy/mm/dd	-	The date that this record was stored.
2	31105-6	Elapsed Time	0.000… 9,999,999	Amount of time (in hours) that has elapsed since the last clear of the peak and average values. Updated at the end of each demand interval.
3	31107-8	Peak Demand kW	± 0.000…9,999,999	The largest magnitude demand for kwatts that occurred over all of the demand intervals since the last clear command or auto-clear day.
4	31109-10	Average Demand kW	± 0.000…9,999,999	A running average of demand for kwatts from the end of each demand period since the last clear command or auto-clear day.
5	31111-12	Load Factor kW	0…100%	Average Demand kW / Peak Demand kW. This is a demand management metric that indicates how 'spiky' (or 'level') a load is over a period of time (usually 1 month). A value approaching 100% indicates a constant load.
6	31113-14	Peak Demand kVAR	± 0.000… 9,999,999	The largest magnitude demand for kVAR that occurred over all of the demand intervals since the last clear command or auto-clear day.
7	31115-16	Average Demand kVAR	± 0.000… 9,999,999	A running average of demand for kVAR from the end of each demand period since the last clear command or auto-clear day.
8	31117-18	Load Factor kVAR	0…100%	Average Demand kVAR / Peak Demand kVAR. This is a demand management metric that indicates how 'spiky' (or 'level') a load is over a period of time (usually 1 month). A value approaching 100% indicates a constant load.
9	31119-20	Peak Demand kVA	0.000… 9,999,999	The largest magnitude demand for kVA that occurred over all of the demand intervals since the last clear command or auto-clear day.
10	31121-22	Average Demand kVA	0.000… 9,999,999	A running average of demand for kVA from the end of each demand period since the last clear command or auto-clear day.
11	31123-24	Load Factor kVA	0…100%	Average Demand kVA / Peak Demand kVA. This is a demand management metric that indicates how 'spiky' (or 'level') a load is over a period of time (usually 1 month). A value approaching 100% indicates a constant load.
12	31125-26	Reserved	0	Reserved for Future Use
13	31127-28	Reserved	0	Reserved for Future Use

Time of Use Log Results - Real Energy and Demand

Table 53 - Table Properties

CSP File No.	F31
CIP Instance	24
No. of Elements	12
No. of Words	24
Data Type	Float
Data Access	Read

Table 54 - Time of Use Log Results - Real Energy and Demand

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	31201-2	Record Number	1…13	•	•	•	The record number of the log. Record 1 is always the current record before being logged.
1	31203-4	Time Stamp Start Date (yy/mm/dd)	-	•	•	•	The Date this record was started.
2	31205-6	Time Stamp End Date (yy/mm/dd)	-	•	•	•	The Date this record was ended.
3	31207-8	Off Peak GWh Net	± 0… 9,999,999	•	•	•	Net Off Peak gigawatt hours
4	31209-10	Off Peak kWh Net	± 0.000… 999,999	•	•	•	Net Off Peak kilowatt hours
5	31211-12	Off Peak kW Demand	± 0.000… 9,999,999			•	Off Peak Demand for kilowatts
6	31213-14	Mid Peak GWh Net	± 0… 9,999,999	•	•	•	Net Mid Peak gigawatt hours
7	31215-16	Mid Peak kWh Net	± 0.000… 999,999	•	•	•	Net Mid Peak kilowatt hours
8	31217-18	Mid Peak kW Demand	± 0.000… 9,999,999			•	Mid Peak Demand for kilowatts
9	31219-20	On Peak GWh Net	± 0.000… 9,999,999	•	•	•	Net On Peak gigawatt hours
10	31221-22	On Peak kWh Net	± 0… 999,999	•	•	•	Net On Peak kilowatt hours
11	31223-24	On Peak kW Demand	± 0.000… 9,999,999			•	On Peak Demand for kilowatts

Time of Use Log Results - Reactive Energy and Demand

Table 55 - Table Properties

CSP File No.	F32
CIP Instance	25
No. of Elements	12
No. of Words	24
Data Type	Float
Data Access	Read

Table 56 - Time of Use Log Results - Reactive Energy and Demand

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	31301-2	Record Number	1…13	•	•	•	The record number of the log. Record 1 is always the current record before being logged.
1	31303-4	Time Stamp Start Date (yy/mm/dd)	-	•	•	•	The Date this record was started.
2	31305-6	Time Stamp End Date (yy/mm/dd)	-	•	•	•	The Date this record was ended.
3	31307-8	Off Peak GVARH Net	± 0… 9,999,999	•	•	•	Net Off peak gigaVAR hours
4	31309-10	Off Peak kVARh Net	± 0.000… 999,999	•	•	•	Net Off Peak kiloVAR hours
5	31311-12	Off Peak kVAR Demand	± 0.000… 9,999,999			•	Off Peak Demand for kiloVAR
6	31313-14	Mid Peak GVARH Net	± 0… 9,999,999	•	•	•	Net Mid Peak gigaVAR hours
7	31315-16	Mid Peak kVARh Net	± 0.000… 999,999	•	•	•	Net Mid Peak kiloVAR hours
8	31317-18	Mid Peak kVAR Demand	± 0.000… 9,999,999			•	Mid Peak Demand for kiloVAR
9	31319-20	On Peak GVARH Net	± 0.000… 9,999,999	•	•	•	Net On Peak gigaVAR hours
10	31321-22	On Peak kVARh Net	± 0… 999,999	•	•	•	Net On Peak kiloVAR hours
11	31323-24	On Peak kVAR Demand	± 0.000… 9,999,999			•	On Peak Demand for kiloVAR

Time of Use Log Results - Apparent Energy and Demand

Table 57 - Table Properties

CSP File No.	F33
CIP Instance	26
No. of Elements	12
No. of Words	24
Data Type	Float
Data Access	Read

Table 58 - Time of Use Log Results - Apparent Energy and Demand

Element No.	Modbus Address	Element Name	Range	BC3	TS3	EM3	Description
0	31401-2	Record Number	1…13	•	•	•	The record number of the log. Record 1 is always the current record before being logged.
1	31403-4	Time Stamp Start Date (yy/mm/dd)	-	•	•	•	The Date this record was started.
2	31405-6	Time Stamp End Date (yy/mm/dd)	-	•	•	•	The Date this record was ended.
3	31407-8	Off Peak GVAh Net	0… 9,999,999	•	•	•	Net Off peak gigaVA hours
4	31409-10	Off Peak kVAh Net	0.000… 999,999	•	•	•	Net Off Peak kiloVA hours
5	31411-12	Off Peak kVA Demand	0.000… 9,999,999			•	Off Peak Demand for kiloVA
6	31413-14	Mid Peak GVAh Net	0… 9,999,999	•	•	•	Net Mid Peak gigaVA hours
7	31415-16	Mid Peak kVAh Net	0.000… 999,999	•	•	•	Net Mid Peak kiloVA hours
8	31417-18	Mid Peak kVA Demand	0.000… 9,999,999			•	Mid Peak Demand for kiloVA
9	31419-20	On Peak GVAh Net	0.000… 9,999,999	•	•	•	Net On Peak gigaVA hours
10	31421-22	On Peak kVAh Net	0… 999,999	•	•	•	Net On Peak kiloVA hours
11	31423-24	On Peak kVA Demand	0.000… 9,999,999			•	On Peak Demand for kiloVA

Catalog Number and WIN

Table 59 - Table Properties

CSP File No.	N34
CIP Instance	27
Applies to	All models
No. of Elements	19
No. of Words	19
Data Type	Integer
Data Access	Read

Table 60 - Catalog Number and WIN

Element No.	Modbus Address	Element Name	Range	Description
0	31501	Catalog # text char pair #1	0…32767	Contains the product number (example: 1408-EM3A-485A, but without the dashes). A read of this table returns the catalog # as 4 integers: each integer contains a character pair. For each character pair, character 1=integer/256 and character 2 = remainder of integer/256.
1	31502	Catalog # text char pair #2		
2	31503	Catalog # text char pair #3		
3	31504	Catalog # text char pair #4		
4	31505	Catalog # text char pair #5		
5	31506	Catalog # text char pair #6		
6	31507	Reserved	0	Reserved for future use.
7	31508	Hardware Series	0…25	Indicates the product series letter. For example, 0=A, 1=B, 2=C…
8	31509	WIN # text char pair #1	0…32767	Contains the product WIN(Warranty Identification Number). This is the same alpha-numeric string that can be found on the master module label (example: 21AW0AT5HO). 5 integers each contains two characters as displayed by the Catalog parameter method.
9	31510	WIN # text char pair #2		
10	31511	WIN# text char pair #3		
11	31512	WIN# text char pair #4		
12	31513	WIN# text char pair #5		
13	31514	Reserved	0	Reserved for future use.
14	31515	Reserved	0	Reserved for future use.
15	31516	Original Model	0…10	This number represents the catalog number type. 0 = TR1 1 = TR2 2 = EM1 3 = EM2 4 = EM3 5 = BC3 6 = TS3 7…10 = Reserved
16	31517	Current Model	0…10	The current model of the product. This can be the same as the original model (if no upgrades have been performed).
17	31518	Reserved	0	Reserved for future use.
18	31519	Reserved	0	Reserved for future use.

Single-element Password Write

Table 61 - Table Properties

CSP File No.	N35
CIP Instance	28
Applies to	All models
No. of Elements	1
No. of Words	1
Data Type	Integer
Data Access	Write

Table 62 - Single-element Password Write

Element No.	Modbus Address	Element Name	Range	Description
0	40901	Table Password	0…9999	When CIP Explicit Message Security is disabled, a write of this table allows any configuration parameter to be written as a single element or poke. The password stays active for 30 minutes and resets to another 30 minutes when a single element is configured. If CIP Explicit Message Security is enabled, a write to this table is ignored.

User Configurable Table Setup

Table 63 - Table Properties

CSP File No.	N44
CIP Instance	29
Applies to	EM3, TS3 only
No. of Elements	17
No. of Words	17
Data Type	Integer
Data Access	Read/Write

Table 64 - User Configurable Table Setup

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	41001	Table Password	0	0…9999	When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	41002	Selection for Parameter #1	29 (L1 Current)	0…110 (EM3) 0…78, 87…110 (TS3)	The parameter list can be found in the Parameters for Configurable Table.
2	41003	Selection for Parameter #2	30 (L2 Current)		
3	41004	Selection for Parameter #3	31 (L3 Current)		
4	41005	Selection for Parameter #4	37 (L1-L2 Voltage)		
5	41006	Selection for Parameter #5	38 (L2-L3 Voltage)		
6	41007	Selection for Parameter #6	39 (L3-L1 Voltage)		
7	41008	Selection for Parameter #7	41 (Frequency)		
8	41009	Selection for Parameter #8	52 (Total Real Power)		
9	41010	Selection for Parameter #9	56 (Total Reactive Power)		
10	41011	Selection for Parameter #10	60 (Total Apparent Power)		
11	41012	Selection for Parameter #11	48 (3 Phase True Power Factor)		
12	41013	Selection for Parameter #12	70 (Real Energy Net (kWh))		
13	41014	Selection for Parameter #13	62 (Status 1 Count x1)		
14	41015	Selection for Parameter #14	64 (Status 2 Count x1)		
15	41016	Selection for Parameter #15	79 (Real Power Demand)		
16	41017	Selection for Parameter #16	8 (Status Input States)		

Table 65 - Parameters for Configurable Table

Parameter No.	Parameter Name	Description	TS3	EM3
0	None	No Parameter.	•	•
1	Date: Year	Refer to Date and Time Configuration table.	•	•
2	Date: Month		•	•
3	Date: Day		•	•
4	Time: Hour		•	•
5	Time: Minute		•	•
6	Time: Seconds		•	•
7	Time: Hundredths		•	•
8	Status Input States	Refer to Discrete Results table.	•	•
9	Output Word		•	•
10	Wiring Status	Refer to Wiring Diagnostics Results table.	•	•
11	Voltage Input Missing		•	•
12	Voltage Input Inverted		•	•
13	Current Input Missing		•	•
14	Current Input Inverted		•	•
15	Voltage Rotation		•	•
16	Current Rotation		•	•
17	Voltage Phase 1 Angle		•	•
18	Voltage Phase 1 Magnitude		•	•
19	Voltage Phase 2 Angle		•	•
20	Voltage Phase 2 Magnitude		•	•
21	Voltage Phase 3 Angle		•	•
22	Voltage Phase 3 Magnitude		•	•
23	Current Phase 1 Angle		•	•
24	Current Phase 1 Magnitude		•	•
25	Current Phase 2 Angle		•	•
26	Current Phase 2 Magnitude		•	•
27	Current Phase 3 Angle		•	•
28	Current Phase 3 Magnitude		•	•
29	L1 Current	Refer to Volts Amps Frequency Results table.	•	•
30	L2 Current		•	•
31	L3 Current		•	•
32	Average Current		•	•
33	L1-N Volts		•	•

Table 65 - Parameters for Configurable Table

Parameter No.	Parameter Name	Description	TS3	EM3
34	L2-N Volts	Refer to Volts Amps Frequency Results table.	•	•
35	L3-N Volts		•	•
36	Average L-N Volts		•	•
37	L1-L2 Volts		•	•
38	L2-L3 Volts		•	•
39	L3-L1 Volts		•	•
40	Average L-L Volts		•	•
41	Frequency		•	•
42	Percent Current Unbalance		•	•
43	Percent Voltage Unbalance		•	•
44	Metering Iteration		•	•
45	L1 True Power Factor	Refer to Power Results table.	•	•
46	L2 True Power Factor		•	•
47	L3 True Power Factor		•	•
48	3 Phase True Power Factor		•	•
49	L1 kW		•	•
50	L2 kW		•	•
51	L3 kW		•	•
52	Total kW		•	•
53	L1 kVAR		•	•
54	L2 kVAR		•	•
55	L3 kVAR		•	•
56	Total kVAR		•	•
57	L1 kVA		•	•
58	L2 kVA		•	•
59	L3 kVA		•	•
60	Total kVA		•	•
61	Status 1 Count xM	Refer to Energy Results table.	•	•
62	Status 1 Count x1		•	•
63	Status 2 Count xM		•	•
64	Status 2 Count x1		•	•
65	GWh Fwd		•	•
66	kWh Fwd		•	•
67	GWh Rev.		•	•
68	kWh Rev.		•	•
69	GWh Net		•	•

Table 65 - Parameters for Configurable Table

Parameter No.	Parameter Name	Description	TS3	EM3
70	kWh Net	Refer to Energy Results table.	•	•
71	GVARH Fwd		•	•
72	kVARh Fwd		•	•
73	GVARH Rev.		•	•
74	kVARh Rev.		•	•
75	GVARH Net		•	•
76	kVARh Net		•	•
77	GVAh Net		•	•
78	kVAh Net		•	•
79	kW Demand	Refer to Demand Results table.		•
80	kVAR Demand			•
81	kVA Demand			•
82	Demand PF			•
83	Projected kW Demand			•
84	Projected kVAR Demand			•
85	Projected kVA Demand			•
86	Elapsed Demand Period Time			•
87	Bulletin Number	Refer to Unit Run Status Results table.	•	•
88	Series Letter		•	•
89	Catalog Device Type		•	•
90	Communication Type		•	•
91	Application FRN		•	•
92	Boot Code FRN		•	•
93	Default Device ID		•	•
94	Accuracy Class		•	•
95	Overall Status		•	•
96	Flash Memory		•	•
97	SRAM		•	•
98	NVRAM		•	•
99	SPI Interface		•	•
100	Real Time Clock		•	•
101	Watchdog Timer		•	•
102	Metering		•	•
103	LCD Interface		•	•
104	Serial Communications		•	•
105	Ethernet Communications		•	•
106	Input Over Range	Refer to Unit Run Status Results table.	•	•
107	Phase Loss Detection		•	•
108	Terminal Locked		•	•
109	Single Element Password Accepted		•	•
110	Error Recorded		•	•

Security Policy Configuration Table

Table 66 - Table Properties

CSP File No.	N45
CIP Instance	30
Applies to	All models
No. of Elements	15
No. of Words	15
Data Type	Integer
Data Access	Read/Write

Table 67 - Security Policy Configuration Table

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	41101	Table Password	0	0…9999	Required for configuration, returns -1. When the applicable security (web or explicit message) is disabled, this parameter allows the input data from the source to be accepted. If the applicable security is enabled, this parameter is ignored. Returns -1 on a read.
1	41102	Hardware Configuration Lock	0	0…1	0 = Lock Analog Input configuration, energy configuration parameters, security policy configuration and command word 1 parameters including unit reset. 1 = Lock Analog Input configuration, energy configuration parameters, security policy configuration and command word 1 parameters including unit reset, lock Ethernet configuration.
2	41103	Communication Port Disable	0	0…2	0 = No physical ports disabled. 1 = Ethernet port disable. 2 = RS485 port disable.
3	41104	Web Page Disable	0	0…1	0 = Enable web page access. 1 = Disable web page access.
4	41105	FTP Port Disable	0	0…1	0 = Enable ftp port access. 1 = Disable ftp port access.
5	41106	Flash Update Disable Configuration Lock	0	0…1	0 = Allow firmware flash update when configuration is locked by hardware. 1 = Disable firmware flash update when configuration is locked by hardware.
6	41107	Flash Update Disable Security Active	0	0…3	0 = Allow firmware flash update when security is enabled. 1 = Disable firmware flash update when security for CIP is enabled. 2 = Disable firmware flash update when security for web page is enabled. IMPORTANT: Under setting 2, the CIP Reset Service is active and can still be used to reset the PowerMonitor 1000 unit. Enable security for CIP to block CIP Reset Service Messages. 3 = Disable firmware flash update when security for CIP or web page is enabled. IMPORTANT: If Security is enabled and the Admin Login source IP address and the Flash Source IP address are the same, then Flash Update is allowed.

Table 67 - Security Policy Configuration Table

Element No.	Modbus Address	Element Name	Default Value	Range	Description
7	41108	HTTPS Enable	0	0…1	0 = HTTPS disable. 1 = HTTPS enable.
8	41109	FTPS Enable	0	0…1	0 = FTPS disable. 1 = FTPS enable.
9	41110	Reserved	0	0	Reserved for future use.
10	41111	Reserved	0	0	Reserved for future use.
11	41112	Reserved	0	0	Reserved for future use.
12	41113	Reserved	0	0	Reserved for future use.
13	41114	Reserved	0	0	Reserved for future use.
14	41115	Reserved	0	0	Reserved for future use.

Security Policy Status

Table 68 - Table Properties

CSP File No.	N46
CIP Instance	31
Applies to	All models
No. of Elements	1
No. of Words	1
Data Type	Integer
Data Access	Read

Table 69 - Security Policy Status

Element No.	Modbus Address	Type	Element Name	Range	Description
0	31901	Int16	Security Policy Status Word	0…32767	The current status of security policy configuration.
		Bit 0	ConfigurationLockClosed	0…1	0 = ConfigurationLockOpen 1 = ConfigurationLockClosed
		Bit 1	EthernetPortDisable	0…1	0 = Ethernet port enabled 1 = Ethernet port disabled
		Bit 2	RS485PortDisable	0…1	0 = RS485 port enabled 1 = RS485 port disabled
		Bit 3	WebPageDisable	0…1	0 = Web page enabled 1 = Web page disabled
		Bit 4	FTPPortDisable	0…1	0 = FTP port enabled 1 = FTP port disabled
		Bit 5	FlashUpdateDisableConfigLock	0…1	0 = Allow firmware flash update when configuration is locked by hardware. 1 = Disable firmware flash update when configuration is locked by hardware.
		Bit6…Bit7	FlashUpdateDisableSecurityActive	0…3	0 = Allow firmware flash update when security is enabled. 1 = Disable firmware flash update when security for CIP is enabled. 2 = Disable firmware flash update when security for web page is enabled. 3 = Disable firmware flash update when security for CIP or web page is enabled.

Table 69 - Security Policy Status

Element No.	Modbus Address	Type	Element Name	Range	Description
0	31901	Bit 8	HTTPSEnable	0…1	0 = HTTPS is disabled 1 = HTTPS is enabled
		Bit 9	FTPSEnable	0…1	0 = FTPS is disabled 1 = FTPS is enabled.
		Bit 10	ApplicationAuthenticationRequired	0…1	0 = False 1 = True
		Bit 11	AdminAuthenticationRequired	0…1	0 = False 1 = True
		Bit 12	HardwareConfigurationLockSetting	0…1	0 = Lock all energy related parameters 1 = Lock all energy related parameters and all Ethernet communication table parameters.
		Bit 13	Reserved	0	
		Bit 14	Reserved	0	
		Bit 15	Reserved	0	

Security User Name Table

Table 70 - Table Properties

CSP File No.	ST47
CIP Instance	32
Applies to	All models
No. of Elements	1
No. of Words	16
Data Type	String
Data Access	Write

Table 71 - Security User Name Table

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	41201-16	Username	0	32 bytes	A single entry table for a 32 character Username entry. Append NULL characters if needed to make the string length 32 characters.

Security Password Table

Table 72 - Table Properties

CSP File No.	ST48
CIP Instance	33
Applies to	All models
No. of Elements	1
No. of Words	16
Data Type	String
Data Access	Write

Table 73 - Security Password Table

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	41301-16	Password	0	32 bytes	A single entry table for a 32 character Password entry. Append NULL characters if needed to make the string length 32 characters.

Table 74 - Table Properties

CSP File No.	N49
CIP Instance	34
Applies to	EM3 only
No. of Elements	9
No. of Words	9
Data Type	Integer
Data Access	Read

Table 75 - Alarm Status Results

Element No.	Modbus Address	Element Name	Range	Description
0	31701	Input Over Range	0…3	0 indicates normal operation. Bit 0 = Voltage Input over range Bit 1 = Current Input over range
1	31702	Phase Loss Detection	0…7	0 Indicates normal running condition. Bit 0 = Loss of phase A Bit 1 = Loss of phase B Bit 2 = Loss of phase C
2	31703	Terminal Locked	0…1	Reports 1 if terminal is locked.
3	31704	KYZ Output Forced	0…3	Indicates Relay/KYZ Output is Forced (1) or Not Forced (0); Forced On (1) or Forced Off (0). Bit 0 = Forced/Not Forced Bit 1 = Forced On/Forced off
4	31705	Status Input	0…3	Indicates status input activated (1) or deactivated (0) Bit 0 = Input 1 Bit 1 = Input 2
5	31706	Energy Register Rollover	0…31	Indicate which energy registers rollover Bit 0 = Wh Register Bit 1 = VARh Register Bit 2 = VAh Register Bit 3 = Status input 1 counter Bit 4 = Status input 2 counter
6	31707	Missed External Demand Sync	0…1	When External Demand Sync is missed, set to 1; when external Demand Sync is met, reset to 0.
7	31708	Reserved	0	Reserved for future use
8	31709	Reserved	0	Reserved for future use

Alarm Log Results

Table 76 - Table Properties

CSP File No.	N50
CIP Instance	35
Applies to	EM3 only
No. of Elements	8
No. of Words	8
Data Type	Integer
Data Access	Read

Table 77 - Alarm Log Results

Element No.	Modbus Address	Element Name	Range	Description
0	31801	Status Record Internal Identifier	1…50	Used to verify record sequence when returning multiple records.
1	31802	Timestamp Year of record	-	The year when the record was recorded.
2	31803	Timestamp Month/Day	-	The month and day when the record was recorded.
3	31804	Timestamp Hour/Minute	-	The hour and minute when the record was recorded.
4	31805	Timestamp Seconds/Hundredths	-	The seconds and hundredths when the record was recorded.
5	31806	Status Event Type	0…512	Indicates the type of alarm event that has occurred.
6	31807	General Code	0…4096	Indicates general information about the alarm event.
7	31808	Information Code	0…256	Indicates specific information about the alarm event.

Table 78 - Alarm Log Code

Status Event Type (Decimal)	Event #	General Code (Decimal)	Code #	Information Code (Decimal)	Code #
Metering Alarm	1	Input Over Range	1	Input Over Range Voltage	1
				Input Over Range Current	2
		Voltage Phase Loss	2	Voltage Channel 1 Loss	1
				Voltage Channel 2 Loss	2
				Voltage Channel 3 Loss	4
Terminal Configuration	2	Terminal Locked	1		
		Terminal Unlocked	2		
Relay/KYZ Output Forced	4	KYZ Forced On	1		
		KYZ Forced Off	2		
Status Input Activated	8	Status Input 1	1		
		Status Input 2	2		
Status Input Deactivated	16	Status Input 1	1		
		Status Input 2	2		
Energy Register Rollover	32	Wh Register	1		
		VARh Register	2		
		VAh Register	4		
		Status Input 1 Register	8		
		Status Input 2 Register	16		
Missed External Demand Sync	64				

TIP This is not truly a data table, but a reply to a PCCC diagnostic status request (used by RSWho to display text and an icon for the power monitor). This data is not accessible by using Modbus communication.

Table 79 - DF1 PCCC Diagnostic Status Reply

Byte	Contents	Description
1	Mode/status	Unused
2	Type extender	EE
3	Extended interface type	34h = DF1 Full Duplex 36h = DF1 Half Duplex Slave 65h = Ethernet
4	Extended processor type	95h = CIP Aware
5	Vendor ID (low byte)	1
6	Vendor ID (high byte)	0
7	Product Type (low byte)	73h
8	Product Type (high byte)	0
9	Product Code (low byte)	B1h
10	Product Code (high byte)	0
11	Major Revision	Beginning from 1
12	Minor Revision	Beginning from 1
13	Status (low byte)	74h
14	Status (high byte)	0
15	Serial Number (lowest byte)	Unique 4 bytes assigned code
16	Serial Number	
17	Serial Number	
18	Serial Number (highest byte)	
19	Product Name length	Product name is expected up to 32 characters
20	Product Name (1st character)	The actual length of the table is depending on the product name length. The byte size of this table is at most 51.
21	Product Name (2nd character)	
22	Product Name (3rd character)	
23	Product Name (4th character)	
24	Product Name (5th character)	
25	Product Name (6th character)	
26	Product Name (7th character)	
27	Product Name (8th character)	
…	…	
51	Product Name (last character)	

Parameter Object Instances

Table 80 - Table Properties

CIP Class Code	0x0F
No. of Parameters	131
Data Type	Varies
Data Access	Read only

Table 81 - Parameter Object Instances

Instance Number	Parameter Object Name	Type	Units	Description	BC3	TS3	EM3
1	DateYear	Int16	Year	The current year	•	•	•
2	DateMonth	Int16	Mon	The current month	•	•	•
3	DateDay	Int16	Day	The current day	•	•	•
4	TimeHour	Int16	Hour	The current hour	•	•	•
5	TimeMinute	Int16	Min	The current minutes	•	•	•
6	TimeSeconds	Int16	Sec	The current seconds	•	•	•
7	TimeHundredths	Int16	N/A	Hundredths of a second	•	•	•
8	InputStates	Int16	N/A	Indicates the current states of the status input.		•	•
9	OutputWord	Int16	N/A	Output Word	•	•	•
10	WiringStatus	Real	N/A	This is the overall status of the wiring diagnostic test.	•	•	•
11	VoltInputMissing	Real	N/A	Reports the voltage missing status on all three phases.	•	•	•
12	VoltInputInvert	Real	N/A	Reports the voltage inverted status on all three phases.	•	•	•
13	CurrInputMissing	Real	N/A	Reports the current missing status on all three phases.	•	•	•
14	CurrtInputInvert	Real	N/A	Reports the current inverted status on all three phases.	•	•	•
15	VoltRotation	Real	N/A	Reports the voltage rotation status on all three phases.	•	•	•
16	CurrRotation	Real	N/A	Reports the current rotation status on all three phases.	•	•	•
17	Volt1Angle	Real	Degree	Shows the present phase angle of this channel.	•	•	•
18	Volt1Magnitude	Real	V	Shows the present magnitude of this phase.		•	•
19	Volt2Angle	Real	Degree	Shows the present phase angle of this channel.	•	•	•
20	Volt2Magnitude	Real	V	Shows the present magnitude of this phase.		•	•
21	Volt3Angle	Real	Degree	Shows the present phase angle of this channel.	•	•	•
22	Volt3Magnitude	Real	V	Shows the present magnitude of this phase.		•	•
23	Curr1Angle	Real	Degree	Shows the present phase angle of this channel.	•	•	•
24	Curr1Magnitude	Real	A	Shows the present magnitude of this phase.		•	•
25	Curr2Angle	Real	Degree	Shows the present phase angle of this channel.	•	•	•
26	Curr2Magnitude	Real	A	Shows the present magnitude of this phase.		•	•
27	Curr3Angle	Real	Degree	Shows the present phase angle of this channel.	•	•	•
28	Curr3Magnitude	Real	A	Shows the present magnitude of this phase.		•	•
29	L1Current	Real	A	Phase 1 scaled RMS Current		•	•

Table 81 - Parameter Object Instances

Instance Number	Parameter Object Name	Type	Units	Description	BC3	TS3	EM3
30	L2Current	Real	A	Phase 2 scaled RMS Current		•	•
31	L3Current	Real	A	Phase 3 scaled RMS Current		•	•
32	AverageCurrent	Real	A	Average RMS Current		•	•
33	L1NVolts	Real	V	Phase 1 scaled RMS Voltage		•	•
34	L2NVolts	Real	V	Phase 2 scaled RMS Voltage		•	•
35	L3NVolts	Real	V	Phase 3 scaled RMS Voltage		•	•
36	AverageLNVolts	Real	V	Averaged RMS Voltage		•	•
37	L1L2Volts	Real	V	Line 1 to Line 2 Volts		•	•
38	L2L3Volts	Real	V	Line 2 to Line 3 Volts		•	•
39	L3L1Volts	Real	V	Line 3 to Line 1 Volts		•	•
40	AverageLLVolts	Real	V	Average Line to Line Volts		•	•
41	Frequency	Real	Hz	Last frequency reading.		•	•
42	CurrUnbalance	Real	%	Percent maximum deviation from Ave.		•	•
43	VoltUnbalance	Real	%	Percent maximum deviation from Ave.		•	•
44	MeterIteration	Real	N/A	Increments by 1 for each new metering calculation.	•	•	•
45	L1TruePF	Real	%	Percent ratio between power and apparent power L1.	•	•	•
46	L2TruePF	Real	%	Percent ratio between power and apparent power L2.	•	•	•
47	L3TruePF	Real	%	Percent ratio between power and apparent power L3.	•	•	•
48	3PhaseTruePF	Real	%	Percent ratio between total power and total apparent power.	•	•	•
49	L1kW	Real	kW	Line 1 kW	•	•	•
50	L2kW	Real	kW	Line 2 kW	•	•	•
51	L3kW	Real	kW	Line 3 kW	•	•	•
52	TotalkW	Real	kW	Total kW	•	•	•
53	L1kVAR	Real	kVAR	Line 1 kVAR	•	•	•
54	L2kVAR	Real	kVAR	Line 2 kVAR	•	•	•
55	L3kVAR	Real	kVAR	Line 3 kVAR	•	•	•
56	TotalkVAR	Real	kVAR	Total kVAR	•	•	•
57	L1kVA	Real	kVA	Line 1 kVA	•	•	•
58	L2kVA	Real	kVA	Line 2 kVA	•	•	•
59	L3kVA	Real	kVA	Line 3 kVA	•	•	•
60	TotalkVA	Real	kVA	Total kVA	•	•	•
61	Status1CountxM	Real	N/A	Status 1 count times 1,000,000		•	•
62	Status1Countx1	Real	N/A	Status 1 count times 1		•	•
63	Status2CountxM	Real	N/A	Status 2 count times 1,000,000		•	•
64	Status2Countx1	Real	N/A	Status 2 count times 1		•	•
65	GWhFwd	Real	GWh	Forward gigawatt hours	•	•	•
66	kWhFwd	Real	kWh	Forward kilowatt hours	•	•	•

Table 81 - Parameter Object Instances

Instance Number	Parameter Object Name	Type	Units	Description	BC3	TS3	EM3
67	GWhRev	Real	GWh	Reverse gigawatt hours	•	•	•
68	kWhRev	Real	kWh	Reverse kilowatt hours	•	•	•
69	GWhNet	Real	GWh	Net gigawatt hours	•	•	•
70	kWhNet	Real	kWh	Net kilowatt hours	•	•	•
71	GVARhFwd	Real	GVARh	Forward gigaVAR hours	•	•	•
72	kVARhFwd	Real	kVARh	Forward kiloVAR hours	•	•	•
73	GVARhRev	Real	GVARh	Reverse gigaVAR hours	•	•	•
74	kVARhRev	Real	kVARh	Reverse kiloVAR hours	•	•	•
75	GVARhNet	Real	GVARh	Net gigaVAR hours	•	•	•
76	kVARhNet	Real	kVARh	Net kiloVAR hours	•	•	•
77	GVAhNet	Real	GVAh	Net gigaVA hours	•	•	•
78	kVAhNet	Real	kVAh	Net kiloVA hours	•	•	•
79	kWDemand	Real	kW	The average real power during the last demand period.			•
80	kVARDemand	Real	kVAR	The average reactive power during the last demand period.			•
81	kVADemand	Real	kVA	The average apparent power during the last demand period.			•
82	DemandPF	Real	%	The average demand for PF during the last demand period.			•
83	ProjkWDemand	Real	kW	The projected total real power for the current period.			•
84	ProjkVARDemand	Real	kVAR	The projected total reactive power for the current period.			•
85	ProjkVADemand	Real	kVA	The projected total apparent power for the current period.			•
86	ElapsedTime	Real	N/A	The amount of time that has elapsed during the current period.			•
87	BulletinNum	Int16	N/A	The bulletin number of product.	•	•	•
88	SeriesLetter	Int16	N/A	Indicates the unit hardware series letter.	•	•	•
89	CatalogNum	Int16	N/A	The catalog number type of this device.	•	•	•
90	CommType	Int16	N/A	The communication type of this device.	•	•	•
91	AppFRN	Int16	N/A	The current firmware revision.	•	•	•
92	BootFRN	Int16	N/A	The current boot code revision.	•	•	•
93	DeviceID	Int16	N/A	A semi-unique number assigned to a device at the time it is manufactured.	•	•	•
94	AccuracyClass	Int16	N/A	Indicates the revenue metering accuracy class of the PowerMonitor 1000 as it is shipped from the factory.	•	•	•
95	OverallStatus	Int16	N/A	0 indicates normal operation. Each bit indicates a different fault condition.	•	•	•
96	FlashMemStatus	Int16	N/A	Report Flash status.	•	•	•
97	SRAMStatus	Int16	N/A	Report SRAM status.	•	•	•
98	NVRAMStatus	Int16	N/A	Report NVRAM status.	•	•	•
99	SPIStatus	Int16	N/A	Report SPI Interface status.	•	•	•
100	RTCStatus	Int16	N/A	Report Real Time Clock status.	•	•	•
101	WDTimerStatus	Int16	N/A	Report watchdog time out.	•	•	•
102	MeteringStatus	Int16	N/A	Report metering status.	•	•	•

Table 81 - Parameter Object Instances

Instance Number	Parameter Object Name	Type	Units	Description	BC3	TS3	EM3
103	LCDStatus	Int16	N/A	Report LCD interface status.		•	•
104	SerialCommStatus	Int16	N/A	Report serial communications status.	•	•	•
105	ENTCommStatus	Int16	N/A	Report ethernet communications status.	•	•	•
106	InputOverRange	Int16	N/A	Indicates voltage and current over range status.	•	•	•
107	PhaseLossDetect	Int16	N/A	Indicates phase loss status.	•	•	•
108	TerminalLocked	Int16	N/A	Reports 1 if terminal is locked.	•	•	•
109	PasswordAccepted	Int16	N/A	Indicates the password is verified and active if value is 1.	•	•	•
110	ErrorRecorded	Int16	N/A	It is incremented by 1 when an internal error happens	•	•	•
111	TSTimesLeft	Int16	N/A	Remaining times for troubleshooting mode	•	•	•
112	TableNum	Int16	N/A	The last table that was written.	•	•	•
113	OffendingElement	Int16	N/A	The first rejected element in the table write.	•	•	•
114	WriteErrorStatusWord	Int16	N/A	The write error status word when a write was made.	•	•	•
115	DegOutofRange	Real	Degree	Degrees out of range was detected.	•	•	•
116	UserSelectPara1	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
117	UserSelectPara2	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
118	UserSelectPara3	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
119	UserSelectPara4	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
120	UserSelectPara5	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
121	UserSelectPara6	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
122	UserSelectPara7	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
123	UserSelectPara8	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
124	UserSelectPara9	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
125	UserSelectPara10	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
126	UserSelectPara11	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
127	UserSelectPara12	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
128	UserSelectPara13	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•

Table 81 - Parameter Object Instances

Instance Number	Parameter Object Name	Type	Units	Description	BC3	TS3	EM3
129	UserSelectPara14	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
130	UserSelectPara15	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•
131	UserSelectPara16	Real	N/A	Parameters previously setup during a write to User Configurable Table Setup Table.		•	•

Specifications

Technical Specifications

Table 82 - Technical Specifications - 1408-BC3A-*xxx*, 1408-TS3A-*xxx*, 1408-EM3A-*xxx*

Attribute	Accuracy in % of Reading at 25 °C (77 °F) 50/60 Hz Unity Power Factor				Nominal / Range
		Applies to			
		BC3	TS3	EM3	
Voltage sense inputs: V1, V2, V3	±0.5%		X	X	Line-neutral rms: 347V / 15…399V Line-line rms: 600V / 26…691V
Current sense input: I1, I2, I3	±0.5%		X	X	5A / 0.05…10.0A rms
Frequency	±0.05 Hz		X	X	50 or 60 Hz / 40…75 Hz
Power functions: kW, kVA, kVAR	EN62053-21:2003 Accuracy Requirement Class 1(1)	X	X	X	
Demand functions: kW, kVA				X	
Energy functions: kWH, kVAH		X	X	X	
Metering update rates	100 mS V, I, Hz 200 mS Power	X	X	X	

(1) Fast transient external influence tested at 2 kV.

Table 83 - Input and Output Specifications - 1408-BC3A-*xxx*, 1408-TS3A-*xxx*, 1408-EM3A-*xxx*

Attribute	Value
Control power	85…264V AC 47…63 Hz 125…250V DC 4 VA max
Voltage sense inputs: V1, V2, V3	Input impedance: 5 M Ω min Input current: 2 mA max
Current sense inputs: I1, I2, I3	Overload withstand: 15 A continuous, 200 A for 1/2 s Burden: 0.05V A Impedance: 0.002 Ω Max crest factor at 5 A is 3.0 Starting current: 5 mA
Status inputs	Contact closure (internal 24V DC) (except BC3)
KYZ output	80 mA at 240V AC / 300V DC (except BC3)

Table 84 - Environmental Specifications - 1408-BC3A-*xxx*, 1408-TS3A-*xxx*, 1408-EM3A-*xxx*

Attribute	Value
Dielectric withstand	UL61010, EN61010 Pollution Degree 2
Terminal blocks	0.34…2.5 mm^2 (22…14 AWG), 75 °C (167 °F) min copper wire only Recommended torque 0.8 N•m (7 lb•in)
Operating temperature	-10…60 °C (14…140 °F)
Storage temperature	-40…85 °C (-40…185 °F)
Humidity	5…95%, noncondensing
Vibration	2.0 g 10…500 Hz
Shock	30 g peak each axis (operating) 50 g peak each axis (nonoperating)

Certifications

The power monitor adheres to these certifications.

EtherNet/IP Network Conformance Testing

All power monitor products equipped with an EtherNet/IP network communication port bear the mark shown. This mark indicates the power monitor has been tested at an Open Device Vendor Association (ODVA) independent test lab and has passed the EtherNet/IP network conformance test. This test provides a level of assurance that the power monitor interoperates with other conformance tested EtherNet/IP network devices (including devices from other vendors). One representative device from the power monitor EtherNet/IP network family of devices; the 1408-EM3-ENT has been tested by ODVA using EtherNet/IP Conformance Test, version A2.8. The ODVA website http://www.odva.org maintains a list of products that have passed the conformance test at one of their test labs.

UL/CU-L

UL 508 listed, File E56639, for Industrial Control Equipment and C-UL Certified.

CE Certification

If this product bears the CE marking, it is approved for installation within the European Union and EEA regions. It has been designed to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 2004/108/EC Electromagnetic Compatibility (EMC) and the following standards, in whole, documented in a technical construction file.

EN55011 – Radiated Electromagnetic Emissions

EN55011 – Conducted Emissions

EN 61326-1 Electrical Equipment for Measurement - EMC Requirements

EN61000 – Immunity

This product is intended for use in an industrial environment.

WARNING: This product is a Class A (industrial) product. In a Class B (residential or commercial) environment, this product can cause radio interference in which case the installer can be required to take extra measures to mitigate the interference.

Low Voltage Directive

This product is tested to meet Council Directive 2006/95/EC Low Voltage, by applying the safety requirements of EN61010-1 and EN 61010-2-030.

This equipment is classified as open equipment and must be installed (mounted) in an enclosure during operation as a means of providing safety protection.

International Standard IEC 529 / NEMA / UL 508 Degree of Protection

The Bulletin 1408 PowerMonitor 1000 unit is rated as IP10 degree of protection per International Standard IEC 529. It is considered an open device per NEMA and UL 508.

Follow the recommended installation guidelines to maintain these ratings.

ANSI/IEEE Tested

Meets or exceeds the Surge Withstand Capability (SWC) C37.90.1 - 2002 for protective relays and relay systems on all power-connection circuit terminations.

Additional EtherNet/IP Information

Common Industrial Protocol (CIP) Objects

The PowerMonitor 1000 unit EtherNet/IP Communication Module supports the following Common Industrial Protocol (CIP).

Table 85 - CIP Object Classes

Class	Object
0x0001	Identity
0x0002	Message Router
0x0004	Assembly
0x004E	Base Energy Object
0x004F	Electrical Energy Object
0x00F5	TCP/IP Interface Object
0x00F6	Ethernet Link Object
0x000F	Parameter Object
0x0037	File Object

Identity Object - CLASS CODE 0x0001

The following three instances of the Identity Object are supported.

Table 86 - Identity Object Instances

Instance	Name	Revision Attribute
1	Image File	The firmware image
2	Boot Loader	The firmware Boot Loader
3	Upgrade File	The firmware Upgrade File

The following class attributes are supported for the Identity Object.

Table 87 - Identity Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	3

Instance 1 of the Identity Object contains the following attributes.

Table 88 - Identity Object Instance 1 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Vendor	UINT	1 = Allen-Bradley units
2	Get	Device Type	UINT	115
3	Get	Product Code	UINT	177
4	Get	Revision Major Revision Minor Revision	Structure of: USINT USINT	Firmware revision of the Control firmware
5	Get	Status	WORD	Bit 0 0 = not owned 1 = owned by master Bit 2 0=Factory Defaulted 1=Configured Bits 4…7 - Extended Status (see Table 89) Bit 8 - Minor Recoverable fault Bit 9 - Minor Unrecoverable fault Bit 10 - Major Recoverable fault Bit 11 - Major Unrecoverable fault
6	Get	Serial Number	UDINT	Unique number for each device
7	Get	Product Name: String Length ASCII String	Structure of: USINT STRING	

Table 89 - Extended Device Status Field (bits 4…7) in 'Status' Instance Attribute 5

Value	Description
0	Self-testing
1	Firmware Update in Progress
2	Communication Fault
3	No I/O connections established
4	Non-Volatile Configuration bad
5	Major Fault - either bit 10 or bit 11 is true (1)
6	At least one I/O connection in run mode
7	At least one I/O connection established, all in idle mode

Message Router - CLASS CODE 0x0002

The following class attributes are supported for the Message Router Object.

Table 90 - Message Router Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1

Table 91 - Class Code 0x0002 Instance 1 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Object_list	STRUCT of	A list of supported objects
		Number	UINT	Number of supported classes in the classes array
		Classes	ARRAY of UINT	List of supported class codes

Assembly Object - CLASS CODE 0x0004

No class attributes are supported.

The following static assembly instance attributes are supported for each assembly instance. But for Attribute 3, some instances only support Get Access.

Table 92 - Assembly Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
3	Set	Data	ARRAY of BYTE	
4	Get	Size	UINT	Number of bytes in Attribute 3

The following services are implemented for the Assembly Object.

Table 93 - Assembly Object Services

Service Code	Service Name
0x0E	Get_Attribute_Single
0x10	Set_Attribute_Single

Refer to Appendix A, PowerMonitor 1000 Data Tables, for more information on Assembly Instances supported.

Base Energy Object - CLASS CODE 0x004E

The following class attributes are supported for the Base Energy Object.

Table 94 - Base Energy Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	2

The following instance attributes are implemented for all Base Energy attributes.

Table 95 - Base Energy Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Semantics of Values
1	Get	Energy/Resource Type	UINT	1 = Electrical
2	Get	Base Energy Object Capabilities	UINT	0 = Energy Measured
3	Get	Energy Accuracy	UINT	
6	Get	Data Status	UINT	0
7	Get	Consumed Energy Odometer	ODOMETER	Energy in kWh
8	Get	Generated Energy Odometer	ODOMETER	Energy in kWh
9	Get	Net Energy Odometer	SIGNED_ODOMETER	Energy in kWh
10	Get	Energy Transfer Rate	Real	Power in kW
12	Get	EPATH	EPATH	03 00 21 00 4F 00 24 01
15	Get	Energy Identifier	STRINGI	PM1000
16	Get/Set	Odometer Reset Enable	BOOL	Default = 0
17	Get	Metering State	BOOL	0 - not metering; 1 - metering

The following services are implemented for the Base Energy Object.

Table 96 - Base Energy Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x01	No	Yes	GetAttributes_All
0x05	No	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

The following table describes the Get_Attributes_All response.

Table 97 - Base Energy Object Class Attributes Get_Attributes_All Response

Attribute ID	Data Type	Name	Value
1	UINT	Energy/Resource Type	Attribute 1 value
2	UINT	Base Energy Object Capabilities	Attribute 2 value
3	UINT	Energy Accuracy	Attribute 3 value
4	UINT	Energy Accuracy Basis	0
5	REAL	Full Scale Reading	0
6	UINT	Data Status	Attribute 6 value
7	ODOMETER	Consumed Energy Odometer	Attribute 7 value
8	ODOMETER	Generated Energy Odometer	Attribute 8 value
9	SIGNED_ODOMETER	Net Energy Odometer	Attribute 9 value
10	REAL	Energy Transfer Rate	Attribute 10 value
11	REAL	Energy Transfer Rate User Setting	0
12	STRUCT of:	Energy Type Specific Object Path	Attribute 12 value
	UINT	Path Size	
	Padded EPATH	Path	
13	UINT	Energy Aggregation Path Array Size	0
14	STRUCT of:	Energy Type Specific Object Path	0
	UINT	Path Size	
	Padded EPATH	Path	
15	STRINGI	Energy Identifier	Attribute 15 value
16	BOOL	Odometer Reset Enable	Attribute 16 value
17	BOOL	Metering State	Attribute 17 value
18	UINT	Extended Data Status	0

Electrical Energy Object - CLASS CODE 0x004F

The following class attributes are supported for the Electrical Energy Object.

Table 98 - Electrical Energy Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	2

The following instance attributes are implemented for all Base Energy attributes.

Table 99 - Electrical Energy Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Semantics of Values
1	Get	Real Energy Consumed Odometer	ODOMETER	Energy in kWh
2	Get	Real Energy Generated Odometer	ODOMETER	Energy in kWh
3	Get	Real Energy Net Odometer	SIGNED_ODOMETER	Energy in kWh
4	Get	Reactive Energy Consumed Odometer	ODOMETER	Energy in kWh
5	Get	Reactive Energy Generated Odometer	ODOMETER	Energy in kWh
6	Get	Reactive Energy Net Odometer	SIGNED_ODOMETER	Energy in kWh
7	Get	Apparent Energy Odometer	ODOMETER	Energy in kWh
9	Get	Line Frequency	Real	Unit: HZ
10	Get	L1 Current	Real	Amps (A)
11	Get	L2 Current	Real	Amps (A)
12	Get	L3 Current	Real	Amps (A)
13	Get	Average Current	Real	Amps (A)
14	Get	Percent Current Unbalance	Real	Percent
15	Get	L1-N Voltage	Real	Volts (V)
16	Get	L2-N Voltage	Real	Volts (V)
17	Get	L3-N Voltage	Real	Volts (V)
18	Get	Average L-N Voltage	Real	Volts (V)
19	Get	L1-L2 Voltage	Real	Volts (V)
20	Get	L2-L3 Voltage	Real	Volts (V)
21	Get	L3-L1 Voltage	Real	Volts (V)
22	Get	Average L-L Voltage	Real	Volts (V)
23	Get	Percent Voltage Unbalance	Real	Percent
24	Get	L1 Real Power	Real	Watts (W)
25	Get	L2 Real Power	Real	Watts (W)
26	Get	L3 Real Power	Real	Watts (W)
27	Get	Total Real Power	Real	Watts (W)
28	Get	L1 Reactive Power	Real	Volt-amps reactive (VAR)
29	Get	L2 Reactive Power	Real	Volt-amps reactive (VAR)

Table 99 - Electrical Energy Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Semantics of Values
30	Get	L3 Reactive Power	Real	Volt-amps reactive (VAR)
31	Get	Total Reactive Power	Real	Volt-amps reactive (VAR)
32	Get	L1 Apparent Power	Real	Volt-amps (VA)
33	Get	L2 Apparent Power	Real	Volt-amps (VA)
34	Get	L3 Apparent Power	Real	Volt-amps (VA)
35	Get	Total Apparent Power	Real	Volt-amps (VA)
36	Get	L1 True Power Factor	Real	Percent
37	Get	L2 True Power Factor	Real	Percent
38	Get	L3 True Power Factor	Real	Percent
39	Get	Three Phase True Power Factor	Real	Percent
40	Get	Phase Rotation	UINT	0 = None 1 = ABC 2 = ACB
41	Get	EPATH	Real	03 00 21 00 4e 00 24 01

The following services are implemented for the Electrical Energy Object.

Table 100 - Electrical Energy Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x01	No	Yes	GetAttributes_All
0x0E	Yes	Yes	Get_Attribute_Single

The following table describes the Get_Attributes_All response.

Table 101 - Electrical Energy Object Class Attributes Get_Attributes_All Response

Attribute ID	Data Type	Name	Value
1	ODOMETER	Real Energy Consumed Odometer	Attribute 1 value
2	ODOMETER	Real Energy Generated Odometer	Attribute 2 value
3	SIGNED_ODOMETER	Real Energy Net Odometer	Attribute 3 value
4	ODOMETER	Reactive Energy Consumed Odometer	Attribute 4 value
5	ODOMETER	Reactive Energy Generated Odometer	Attribute 5 value
6	SIGNED_ODOMETER	Reactive Energy Net Odometer	Attribute 6 value
7	ODOMETER	Apparent Energy Odometer	Attribute 7 value
8	ODOMETER	Kiloampere-Hours Odometer	0
9	REAL	Line Frequency	Attribute 9 value
10	REAL	L1 Current	Attribute 10 value
11	REAL	L2 Current	Attribute 11 value
12	REAL	L3 Current	Attribute 12 value
13	REAL	Average Current	Attribute 13 value
14	REAL	Percent Current Unbalance	Attribute 14 value

Table 101 - Electrical Energy Object Class Attributes Get_Attributes_All Response

Attribute ID	Data Type	Name	Value
15	REAL	L1-N Voltage	Attribute 15 value
16	REAL	L2-N Voltage	Attribute 16 value
17	REAL	L3-N Voltage	Attribute 17 value
18	REAL	Average L-N Voltage	Attribute 18 value
19	REAL	L1-L2 Voltage	Attribute 19 value
20	REAL	L2-L3 Voltage	Attribute 20 value
21	REAL	L3-L1 Voltage	Attribute 21 value
22	REAL	Average L-L Voltage	Attribute 22 value
23	REAL	Percent Voltage Unbalance	Attribute 23 value
24	REAL	L1 Real Power	Attribute 24 value
25	REAL	L2 Real Power	Attribute 25 value
26	REAL	L3 Real Power	Attribute 26 value
27	REAL	Total Real Power	Attribute 27 value
28	REAL	L1 Reactive Power	Attribute 28 value
29	REAL	L2 Reactive Power	Attribute 29 value
30	REAL	L3 Reactive Power	Attribute 30 value
31	REAL	Total Reactive Power	Attribute 31 value
32	REAL	L1 Apparent Power	Attribute 32 value
33	REAL	L2 Apparent Power	Attribute 33 value
34	REAL	L3 Apparent Power	Attribute 34 value
35	REAL	Total Apparent Power	Attribute 35 value
36	REAL	L1 True Power Factor	Attribute 36 value
37	REAL	L2 True Power Factor	Attribute 37 value
38	REAL	L3 True Power Factor	Attribute 38 value
39	REAL	Three Phase True Power Factor	Attribute 39 value
40	UINT	Phase Rotation	Attribute 40 value
41	STRUCT of:	Associated Base Energy Object Path	Attribute 41 value
	UINT	Path Size	
	Padded EPATH	Path	

TCP/IP Interface Object - CLASS CODE 0x00F5

The following class attributes are supported for the TCP/IP Interface Object.

Table 102 - TCP/IP Interface Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	4
2	Get	Max Instance	UINT	1
3	Get	Number of Instances	UINT	1

The following instance attributes are implemented for all TCP/IP Interface attributes.

Table 103 - TCP/IP Interface Object Instance Attributes

Attribute ID	Access Rule	Data Type	Name	Value
1	Get	DWORD	Interface status	
2	Get	DWORD	Configuration Capability	
3	Get	DWORD	Configuration Control	
4	Get	STRUCT of:	Physical Link Object	
		UINT	Path size	
		Padded EPATH	Path	
5	Get	STRUCT of:	Interface Configuration	
		UDINT	IP Address	
		UDINT	Network Mask	
		UDINT	Gateway Address	
		UDINT	Name Server	
		UDINT	Name Server 2	
		STRING	Domain Name	
6	Get	STRING	Host Name	
8	Get	USINT	TTL Value	
9	Get	STRUCT of:	Mcast Config	
		USINT	Alloc Control	
		USINT	Reserved	
		UINT	Num Mcast	
		UDINT	Mcast Start Addr	
10	Get	BOOL	SelectAcd	
11	Get	STRUCT of:	LastConflictDetected	
		USINT	AcdActivity	
		Array of 6 USINT	RemoteMAC	
		ARRAY of 28 USINT	ArpPdu	

The following services are implemented for the TCP/IP Interface object.

Table 104 - TCP/IP Interface Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x01	No	Yes	GetAttributes_All
0x0E	Yes	Yes	Get_Attribute_Single

Table 105 - TCP/IP Interface Object Class Attributes Get_Attributes_All Response

Attribute ID	Data Type	Name	Value
1	DWORD	Interface status	
2	DWORD	Configuration Capability	
3	DWORD	Configuration Control	
4	STRUCT of:	Physical Link Object	
	UINT	Path size	
	Padded EPATH	Path	
5	STRUCT of:	Interface Configuration	
	UDINT	IP Address	
	UDINT	Network Mask	
	UDINT	Gateway Address	
	UDINT	Name Server	
	UDINT	Name Server 2	
	STRING	Domain Name	
6	STRING	Host Name	
7	6 octets	Safety Network Number	
8	USINT	TTL Value	
9	STRUCT of:	Mcast Config	
	USINT	Alloc Control	
	USINT	Reserved	
	UINT	Num Mcast	
	UDINT	Mcast Start Addr	
10	BOOL	SelectAcd	
11	STRUCT of:	LastConflictDetected	
	USINT	AcdActivity	
	Array of 6 USINT	RemoteMAC	
	ARRAY of 28 USINT	ArpPdu	
12	BOOL	EtherNet/IP QuickConnect	
13	UINT	Encapsulation Inactivity Timeout	

Ethernet Link Object - CLASS CODE 0x00F6

The following class attributes are supported for the Ethernet Link Object.

Table 106 - Ethernet Link Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	3
2	Get	Max Instance	UINT	1
3	Get	Number of Instances	UINT	1

The following instance attributes are implemented for all TCP/IP Interface attributes.

Table 107 - Ethernet Link Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Interface Speed	UDINT	
2	Get	Interface Flags	DWORD	
3	Get	Physical Address	ARRAY of 6 USINTs	
6	Get	Interface Control	STRUCT of:	
		Control Bits	WORD	
		Forced Interface Speed	UINT	
7	Get	Interface Type	USINT	
8	Get	Interface State	USINT	
9	Get	Admin State	USINT	
10	Get	Interface Label	SHORT_STRING	

The following services are implemented for the TCP/IP Interface object.

Table 108 - Ethernet Link Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x01	No	Yes	GetAttributes_All
0x0E	Yes	Yes	Get_Attribute_Single

Table 109 - Ethernet Link Object Class Attributes Get_Attributes_All Response

Attribute ID	Data Type	Name	Value
1	UDINT	Interface Speed	
2	DWORD	Interface Flags	
3	ARRAY of 6 USINTs	Physical Address	
4	STRUCT of:	Interface Counters	
	UDINT	In Octets	
	UDINT	In Ucast Packets	
	UDINT	In NUcast Packets	
	UDINT	In Discards	
	UDINT	In Errors	
	UDINT	In Unknown Protos	
	UDINT	Out Octets	
	UDINT	Out Ucast Packets	
	UDINT	Out NUcast Packets	
	UDINT	Out Discards	
	UDINT	Out Errors	
5	STRUCT of:	Media Counters	
	UDINT	Alignment Errors	
	UDINT	FCS Errors	
	UDINT	Single Collisions	
	UDINT	Multiple Collisions	
	UDINT	SQE Test Errors	
	UDINT	Deferred Transmissions	
	UDINT	Late Collisions	
	UDINT	Excessive Collisions	
	UDINT	MAC Transmit Errors	
	UDINT	Carrier Sense Errors	
	UDINT	Frame Too Long	
	UDINT	MAC Receive Errors	
6	STRUCT of:	Interface Control	
	WORD	Control Bits	
	UINT	Forced Interface Speed	
7	USINT	Interface Type	
8	USINT	Interface State	
9	USINT	Admin State	
10	SHORT_STRING	Interface Label	

Parameter Object - CLASS CODE 0x000F

The PowerMonitor 1000 unit supports the Parameter Object (0x0f), which provides a known, public interface to a device's readable or configuration data.

Table 110 - Class Attributes for the Parameter Object

Number	Access Rule	Name	Data Type	Description of Attribute	Semantics of Values
1	Get	Revision	UINT	Revision of object class definition	This is revision 1
2	Get	Maximum Instance	UINT	Maximum instance number of an object currently created in this class level of the device.	Maximum instance is 131 in PM1000.
8	Get	Parameter Class Descriptor	WORD	Bits that describe parameters.	0b00000011 (1)Individual Parameter instances ARE supported (2)All Full Parameter Attributes ARE supported.
9	Get	Configuration Assembly Instance	UINT	Instance number of the configuration assembly.	0 means a configuration assembly is not supported.

Table 111 - Instance Attributes for the Parameter Object

Number	NV	Access Rule	Name	Data Type	Description of Attribute	Supported Values
1	NV	Set	Parameter Value	Data type specified in Descriptor, Data Type and Data Size.	Actual value of parameter. It can be read from or written to.	See 3.1.4
2	NV	Get	Link Path Size	USINT	Size of link path. If this attribute is 0, then no link is specified.	Number of bytes (0x06)
3	NV	Get	Link Path	Packet EPATH	CIP path to the object from where this parameter's value is retrieved.	The Link Path is limited to 255 bytes
4	NV	Get	Descriptor	Word	Description of parameter.	See 3.1.4
5	NV	Get	Data Type	EPATH	Data type code.	See 3.1.4
6	NV	Get	Data Size	USINT	Number of bytes in Parameter Value	See 3.1.4
7	NV	Get	Parameter Name String	SHORT_ STRING	A human-readable string representing the parameter name.	See 3.1.4
8	NV	Get	Units String	SHORT_ STRING	Engineering Unit String.	See 3.1.4
9	NV	Get	Help String	SHORT_ STRING	Help String.	See 3.1.4
10	NV	Get	Minimum Value	Data type	Generally, the minimum value to which the parameter can be set.	See 3.1.4
11	NV	Get	Maximum Value	Data type	Generally, the maximum value to which the parameter can be set.	See 3.1.4
12	NV	Get	Default Value	Data type	The actual value the parameter is set to when the user wants the default for the parameter.	See 3.1.4
13	NV	Get	Scaling Multiplier	UINT	Multiplier for Scaling Factor.	0x01
14	NV	Get	Scaling Divisor	UINT	Divisor for Scaling Formula.	0x01
15	NV	Get	Scaling Base	UINT	Base for Scaling Formula.	0x01
16	NV	Get	Scaling Offset	INT	Offset for Scaling Formula.	0x00
17	NV	Get	Multiplier Link	UINT	Parameter Instance of Multiplier source.	0x00
18	NV	Get	Divisor Link	UINT	Parameter Instance of Divisor source.	0x00
19	NV	Get	Base Link	UINT	Parameter Instance of Base source.	0x00
20	NV	Get	Offset Link	UINT	Parameter Instance of Offset source.	0x00
21	NV	Get	Decimal Precision	USINT	Places to use when displaying the scaled engineering value. Also used to determine actual increment value so that incrementing a value causes a change in scaled engineering value to this precision.	0x00

Table 112 - Parameter Object Common Services

Service Code (Hex)	Need in Implementation		Service Name	Description of Service
	Class	Instance		
0x0E	Required	Required	Get_Attribute_Single	Gets the specified attributes of the class or the instance
0x10	N/A	Required	Set_Attribute_Single	Modifies an attribute value.
0x01	N/A	Required	Get_Attributes_All	Returns a predefined listing of this objects attributes

Refer to Appendix A, PowerMonitor 1000 Data Tables, for a listing of Parameter Object Instances (p. hhh)

File Object - CLASS CODE 0x0037

The following class attributes are supported for the File Object.

Table 113 - File Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	0xC8
3	Get	Number of Instances	UINT	1
6	Get	Maximum ID Number Class Attributes	UINT	32
7	Get	Maximum ID Number Instance Attributes	UINT	11
32	Get	Directory	Array of Struct	
		Instance Number	UINT	0xC8
		Instance_Name	STRINGI	1, 'eng', 0xDA, 4, 18, 'EDS and Icon Files'
		File_Name	STRINGI	1, 'eng', 0xDA, 4, 6, 'EDS.gz'

Table 114 - Class Code 0x0037 Instance 0xC8 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = File Empty (no file loaded) 2 = File Loaded 3 = Transfer Upload initiated 4 = Transfer Download initiated 5 = Transfer Upload in Progress 6 = Transfer Download in Progress 7 = Storing 8…255 = Reserved
2	Get	Instance Name	STRINGI	1, "eng", 0xDA, 4, 18, "EDS and Icon Files"
3	Get	Instance Format Version	UINT	1
4	Get	File Name	STRINGI	1, "eng", 0xDA, 4, 6, "EDS.gz"
5	Get	File Revision	USINT USINT	EDS File Revision
6	Get	File Size	UDINT	EDS File Size
7	Get	File Checksum	INT	EDS File Checksum
8	Get	Invocation Method	USINT	0
9	Get	File Save Parameters	BYTE	0
10	Get	File Type	USINT	1 = Read Only
11	Get	File Encoding Format	USINT	1 = Compressed EDS and Icon files for this device

Table 115 - File Object Common Services

Service Code (Hex)	Need in Implementation		Service Name	Description of Service
	Class	Instance		
0x0E	Required	Required	Get_Attribute_Single	Gets the specified attributes of the class or the instance
0x10	N/A	Required	Set_Attribute_Single	Modifies an attribute value

Table 116 - File Object Object-specific Services

Service Code (Hex)	Need in Implementation		Service Name	Description of Service
	Class	Instance		
0x4B	N/A	Required	Initiate_Upload	Used to start a file upload
0x4C	N/A	Required	Initiate_Download	Used to start a file download
0x4F	N/A	Required	Upload_Transfer	Performs a file transfer upload
0x50	N/A	Required	Download_Transfer	Performs a file transfer download
0x51	N/A	Required	Clear File	Clears a loaded file

Notes:

History of Changes

This appendix summarizes the revisions to this manual. Reference this appendix if you need information to determine what changes have been made across multiple revisions. This can be especially useful if you are deciding to upgrade your hardware based on information added with previous revisions of this manual.

1408-UM001D-EN-P, September 2013

Change
Updated Unit Certifications, Appendix D

1408-UM001C-EN-P, June 2011

Change
Updated User Configurable Table CSP file number
Added unit configuration information, Appendix B
Added unit specifications, Appendix C
Added Unit Certifications, Appendix D

1408-UM001B-EN-P, May 2008

Change
Added DH485 to the serial communication protocol table.
Added section with information about DH485.
Added that the Ethernet communication port supports 10 or 100 Mbps data rate, half-duplex, or full-duplex.
Added DH485 to the communication command summary.
Added information about explicit messaging instructions apply to Ethernet communication and serial communication.
Added instructions to configure RSLinx software driver configuration for DH485.
Added information for using the DH485 driver.
Added information for OPC tag browsing.
Added information about a user configured data table.
Added User Configured Table Results Parameters table.
Added User Configured Table Results table.
Added element 5 to Analog Input Configuration table.

Change
Updated elements 5 and 7 to Advanced Configuration table.
Updated Serial RS-485 Port Configuration table.
Updated Command table.
Added element 10 to the Log Request table.
Updated Wiring Diagnostics Results table.
Updated Unit Run Status Results table.
Added User Configurable Table Setup Parameters table.
Added User Configured Table Setup table.
Added Parameters for Configurable table.

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